4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

4.1 INTRODUCTION

This section addresses potential environmental consequences for each of the project alternatives identified in Section 2. Four phases of project activities have been identified: construction; normal operations; closure; and accidents and/or natural disasters. Potential environmental impacts associated with construction, normal operations, and accidents (including oil spills) are specifically addressed in this EA.

Each subsection includes a discussion of potential environmental consequences associated with the proposed project and alternatives, along with a discussion of cumulative impacts and mitigation measures. Project activities during each phase are described below.

4.1.1 Construction

For the proposed project, the construction phase includes the conversion of the Osprey Platform from exploratory to production operations, construction of underwater and onshore pipelines, and construction of a new onshore production facility near Kustatan. Conversion of the Osprey Platform includes the installation of production equipment on the platform. Construction of the 1.8-mile underwater pipelines and utilities will be conducted using the pipe pull method. The pipelines will be buried near the shore and will be brought onshore by trenching and cutting through the bluff. The technical feasibility of placing the pipeline through an augured hole adjacent to the beach bluff (rather than trenching and cutting through the bluff) is currently being evaluated. Onshore pipelines and an access road will be constructed from the bluff about 1.8 miles through an area containing wetlands and archaeological resources to an onshore production facility. The proposed onshore facility will be located on property owned by Forest Oil.

Under Alternative 2, a 3.3-mile underwater pipeline would be installed using the lay barge method. The pipeline would come onshore near the proposed production facility. Under Alternative 3, a 10.5-mile underwater pipeline would be installed using the lay barge method. A 0.1-mile onshore pipeline would be constructed near the Trading Bay production facility. The Kustatan Production Facility would not be constructed. Under Alternative 4, no construction would occur. The Osprey Platform would be floated away to another location; existing exploratory wells would be sealed and abandoned.

Potential construction impacts specific to each impact area are discussed in Sections 4.2 through 4.16.

4.1.2 Normal Operations

Impacts during normal production operations include those related to permitted discharges from the Osprey Platform, as well as ongoing and routine air emissions and noise from the platform (Alternatives 1, 2, and 3) and the Kustatan Production Facility (Alternatives 1 and 2). Under Alternative 4, no production operations would occur. Potential impacts during normal operations specific to each impact area are discussed in Sections 4.2 through 4.16.

4.1.3 Closure

Closure activities include removal of the Osprey Platform, abandonment of pipelines, and closure/reclamation of the production facility. Potential environmental impacts associated with closure activities are not specifically addressed in this EA. Appropriate environmental review will be conducted in the future when a site-specific closure plan is submitted.

4.1.4 Accidents and Natural Disasters

The most significant potential environmental impacts associated with accidents and natural disasters result from releases of oil and gas to the water, land, and air. Oil spills can result from pipeline leaks and/or pipe failure (both onshore and in Cook Inlet), accidents on the Osprey Platform, accidents related to the onshore production facility, and other causes such as collisions with vessels. Natural disasters include earthquakes and volcanism; however, environmental impacts related to natural disasters would result primarily from releases of oil and gas. Releases of diesel fuel and other potentially toxic materials could also occur.

There have been no reported failures (i.e., leaks or ruptures) at any of the onshore pipelines in Cook Inlet (Belmar 1993). However, a number of failures of the Cook Inlet underwater pipelines have occurred. Pipeline failures have been caused by current-induced vibration (e.g., vortex shedding), riser failures, pipeline rubbing, damage from ice scour, and minor flange leaks. All 15 reported pipeline failures due to current-induced vibration occurred on unsupported pipeline spans of about 100 feet or more (Belmar 1993). The pipeline design criteria for the proposed project specify maximum allowable spans of 26 feet to minimize the potential for current-induced vibration failures. A number of pipeline riser failures due to external corrosion have occurred in Cook Inlet. At least one pipeline failure occurred due to rubbing of the pipeline on an exposed rock. Internal and external monitoring, as well as a SCADA monitoring and control system, will be utilized on the proposed project to minimize the potential for these types of failures. Unburied pipelines on the west side of Cook Inlet have occasionally been damaged by ice floes (Belmar 1993). Burial of the proposed pipelines in the intertidal area will minimize potential ice damage.

Pipeline damage from anchors in Cook Inlet would normally occur in areas of large vessel traffic, particularly in the immediate vicinity of major port facilities where anchoring is sometimes required for maneuvering or for holding while awaiting dock space. The proposed pipelines are not located in either a normal large vessel traffic lane or in the vicinity of a major port facility. The normal shipping lanes for large vessel traffic would be in the main channel of Cook Inlet located east of the Osprey Platform; larger vessels operating in the Inlet would avoid the shallower water depths in the general pipeline area.

Potential spills and leaks from operations onboard the Osprey Platform could include a diesel tank rupture, a production well blowout, or minor spills associated with resupply operations by support vessels. Spills and leaks could also occur at the Kustatan Production Facility. Potential spill sources include oil and produced water tank ruptures as well as pipeline failures.

Major spill sources and potential volumes are identified in Table 4-1 for the proposed project. Smaller spills are much more likely and could have volumes ranging from a few gallons to 1000 barrels.

Although the Osprey Platform is not in the Alaska Outer Continental Shelf (OCS), OCS statistics on oil spills were evaluated as the operations are similar (NCG 2001). During exploration in OCS waters from 1982 to 1991, 52 exploration wells were drilled with five spills greater than one barrel; the total spillage from these events was 45 barrels (MMS 1996b). From these data, MMS determined a spill rate of 11 spills per 100 exploratory wells with an average spill size of 9 barrels.

Spills would probably be more frequent during production operations, but the spill size would likely be small (MMS 1996b). Between 1971 and 1980, the spill rate for Cook Inlet was 265 spills per billion barrels produced and transported. The average size of these spills was 4.4 barrels, and none of the spills was greater than 1,000 barrels (MMS 1996b).

In OCS producing areas between 1970 and 1992, there were 1,812 spills in the range of one to less than 50 barrels while producing 7.7 billion barrels of crude oil and condensate. This equates to a spill rate for these smaller spills (1 to <50 barrels) of 234 spills per billion barrels produced with an average spill size of 5 barrels (MMS 1996b). In OCS producing areas from 1964 to 1992, the offshore-oil industry spilled 14,000 barrels in 88 spills in the range of 50 to less than 1,000 barrels while producing 8.96 billion barrels of crude oil and condensate (MMS 1996b). This equates to a spill rate of 9.8 spills (in the 50 to <1,000-barrel range) per billion barrels produced with an average spill size of 160 barrels (MMS 1996b). For spills greater than 1,000 barrels, the average spill rates for platforms were 0.60 spills per billion barrels produced, and for pipelines were 0.67 spills per billion barrels produced (MMS 1996b). The average spill sizes for platform and pipeline spills were 18,000 and 22,000 barrels, respectively.

Although the exact oil reserves for the Redoubt Shoal Unit Development Project are not known, Forest Oil estimates it is between 25 and 50 million barrels (NCG 2001). Table 4-2 summarizes the potential oil spill risk for the proposed project based on the above MMS statistics.

Additional statistics are also available from an industry-sponsored risk assessment for Cook Inlet operations (PLG 1990). Spill rates from various activities were developed; extrapolating these spill rates over a conservative project life of 30 years leads to the following predictions for the proposed project (NCG 2001):

- Platform spills > 50 barrels: 0.42 spills
- Underwater pipeline rupture/leak: 0.039 spills
- Onshore pipeline rupture/leak: 0.14 spills

These estimates are consistent with the oil spill potential for the proposed project calculated from MMS statistics (Table 4-2). Based on a conservative estimate of a 30-year project duration, 0.087 spills are predicted for the underwater pipeline under Alternative 2 (offshore pipeline to Kustatan) and 0.27 spills are predicted for the underwater pipeline under Alternative 3 (offshore pipeline to Trading Bay), based on statistics presented by PLG (1990). For the onshore pipeline, 0.1 spills and 0.028 spills are predicted for Alternatives 2 and 3, respectively, over a 30-year project life (NCG 2001).

Potential impacts related to oil and gas spills specific to each impact area are discussed in Sections 4.2 through 4.16.

4.1.5 Cumulative Impacts

Oil and gas exploration and development projects have been conducted in the Cook Inlet area since the late-1950s onshore and since the mid-1960s offshore. At present, there are 14 offshore oil and gas production platforms and over 500 miles of underwater pipeline in the upper Cook Inlet and associated onshore facilities along the shores of the inlet. There is also associated marine transport of both crude oil and refined products within the inlet waters. In general these operations have been declining over the past several decades with the reduced oil production in the Cook Inlet area.

The proposed activities would include operation of one additional offshore production platform, placement of about 7 additional miles of underwater pipeline (3 pipelines) and construction of one

additional onshore production facility. Within the context of existing regional conditions, these would be neither unusual nor add significantly to potential cumulative effects from oil and gas operations in the Cook Inlet area. Activities from the project may tend to slightly offset effects of reduced oil production in the region by providing direct and indirect employment opportunities to local communities.

Potential cumulative impacts specific to each impact area are discussed in Sections 4.2 through 4.16.

4.1.5.1 Environmental Impacts from the Oil and Gas Industry

During the four decades that oil and gas operations have been conducted in the Cook Inlet area, oil spills and other releases have occurred. A number of area-wide studies have been conducted to assess possible cumulative impacts from oil and gas operations in the Cook Inlet area.

A recent study was conducted by the Cook Inlet Regional Citizens Advisory Group (CIRCAC). CIRCAC, a citizen's oversight council for oil industry operations in the Cook Inlet region, was established according to Section 5002 of the Oil Pollution Act of 1990. One of the CIRCAC mandates is to conduct monitoring to assess environmental impacts of oil industry operations in Cook Inlet. To this end, CIRCAC initiated an environmental monitoring program that has been conducted annually since 1994. The program generally includes monitoring of hydrocarbon concentrations in marine sediments, the water column, and in marine organisms to assess the general health of Cook Inlet. CIRCAC's most recent report (Lees et al. 1999) lists the following conclusions:

Sediment Hydrocarbon Levels:

- Sediment samples had extremely low levels of polynuclear aromatic hydrocarbons (PAHs).
- The sources of hydrocarbons were varied and mixed, but could not be directly attributed to Cook Inlet oil and gas development operations.
- There was no evidence of the *Exxon Valdez* Oil Spill (EVOS) or Alaska North Slope (ANS) oil observed in any of the subtidal sediments in the Cook Inlet area.
- Sediments did not contain concentrations of hydrocarbons which would cause mortality or sublethal effects to organisms.

Marine Organism Tissue Hydrocarbon Burdens:

- Subtidal organisms living in the region exhibited no indication of accumulation or exposure to high levels of hydrocarbons from Cook Inlet oil and gas activities.
- In a few instances, minimal exposure of intertidal organisms was indicated:
    1. Extremely weathered EVOS residues plus fresh diesel were encountered in mussels at one site in Shelikof Strait.
    2. Mixtures of diesel and very low-level combustion-derived (pyrogenic) hydrocarbons were noted in tissues of *Macoma balthica* from Tuxedni Bay.
    3. Fresh oil seep signals (from natural sources) were possibly observed in tissues of *Macoma balthica* from Chinitna Bay.

Water Column Hydrocarbons:

- Deployment of caged mussels near produced water discharge outfalls generally failed to show any evidence of PAH accumulation, although this could have been due to extreme stress in the deployed mussels due to high suspended-particulate loads or other environmental factors.
- Evidence of a produced water PAH signal was observed in the Trading Bay area, and what was presumably a weathered diesel signal was observed in Kachemak Bay.

Hydrocarbon Sources:

- Subtidal coal outcrops or river-borne particulate coal from terrestrial sources may contribute significant levels of PAH to the sediments throughout the region.
- Total naphthalenes/total PAH ratios tend to increase with sand-sized particulates suggesting a particulate coal-derived source for much of the PAH observed in the sediments.
- Samples from the Kenai River show a PAH signature similar to samples from other areas of the inlet. These upriver samples from terrestrial sources most likely represent erosion of coal deposits in the watershed area.
- Very few of the low-level PAH signatures for either sediments or tissues could be directly tied to specific sources; the samples suggested either undocumented sources or mixtures from multiple sources.

Lees et al. (1999) concluded, based on the overwhelming weight of evidence, that hydrocarbon contamination or effects related to hydrocarbon exposure are either lacking or, if observed, occur at levels very near the detection limits. Observations indicated no evidence of contamination from oil activities in Cook Inlet or effects that could be related to hydrocarbon concentrations in the sediment. The only methodology that exhibited a relevant response was placement of arrays of organisms near a produced water discharge in Trading Bay. Other approaches exhibited responses to environmental factors, but did not exhibit a significant correlation with petroleum hydrocarbons (e.g., effects associated with oil and gas operations in Cook Inlet).

4.1.5.2 Other Projects That Could Contribute to Cumulative Impacts

A number of other projects are currently in various stages of planning and/or development in the Cook Inlet region. These are listed on Table 4-3 and their locations shown on Figure 4-1. Projects that are currently proposed or recently completed that are within the immediate project area (i.e., within a 10-mile radius of the proposed project) include:

Forest Oil's Tomcat Onshore Exploration Drilling Project. The Tomcat Exploration Drilling Project included the construction of an access road between the West Forelands #1 site and a drilling location in the general vicinity of the proposed onshore production facility near Kustatan. The access road was built during the summer of 2000, and subsequent drilling activities were conducted in the fall of 2000. Based on the recently-completed drilling activities, commercial reserves were not identified and therefore further development of the Tomcat Project will not occur.

The proposed project will use the existing concrete pad for construction of the Kustatan Production Facility, and will use the access road for the Tomcat Exploration Drilling Project. Pipelines will be placed alongside the access road. The existing drilling site and other infrastructure developed as part of the Tomcat Project will be used for the proposed project to the extent possible. This includes conversion

of the existing Tomcat exploration well to a deep groundwater well to provide makeup water for pressure maintenance in the Redoubt Shoal Unit.

Two pipelines are planned between the onshore production facility and the Trading Bay Production Facility:

- One 6-inch pipeline to carry natural gas from the onshore production facility to the Trading Bay Production Facility. The pipeline would tie into an existing natural gas pipeline between the West Forelands #1 site and the West McArthur River Unit. The use of an existing gas pipeline between West McArthur River Unit and the Trading Bay Production Facility is currently being evaluated (NCG 2001). An estimated 2.1 million standard cubic feet per day of dry natural gas will be transported at 300 psig and 100°F. The West McArthur River Unit may use some of the natural gas.
- One 8-inch pipeline to carry crude oil from the onshore production facility to the Cook Inlet Pipe Line Company oil pipeline system located at the Trading Bay Production Facility. An estimated 25 thousand barrels per day of oil will be transported at approximately 450 psig.

The pipelines will be placed in a trench adjacent to the existing access road between the proposed onshore production facility and the West McArthur River Unit and next to existing pipelines between the West McArthur River Unit and the Trading Bay Production Facility. The line will have a nominal depth of burial of 3 feet. Appropriate bedding materials will be placed to reduce the potential for damage to the pipe. The pipeline locations were included in the original Corps of Engineers submittal for the road/pipeline route to the Tomcat exploratory well location.

UNOCAL's Cross Inlet Oil Pipeline. A cross-inlet oil pipeline has been examined at least once in the past, and was determined to be uneconomical. UNOCAL's current project is still in the conceptual/economic evaluation stage, and preliminary information suggests there is limited support for the project. Chances that this project will proceed are considered low (i.e., less than 50 percent; NCG 2001).

ARCO's Alaska North Slope LNG Project. The Alaska North Slope LNG Project includes construction of a natural gas pipeline to either Nikiski (Cook Inlet area) or to Anderson Bay (Port Valdez/Prince William Sound area). Similar gas pipeline projects have been proposed numerous times in the past, and all have been found to either be uneconomic or lack gas markets. Chances that this project will proceed with a terminal at Nikiski is considered low (i.e., less than 50 percent; NCG 2001).

Other Projects in the Cook Inlet Area. The following projects in the Cook Inlet area are believed to have a high likelihood of occurring within the foreseeable future (or are currently in progress):

- Marathon's Wolf Lake Gas Project
- Anadarko/Phillip's Lone Creek Gas Project
- Matanuska-Susitna Borough's Point Mackenzie Port Development
- Corps of Engineer's Knik Arm Dredging Project

Both the Wolf Lake and Lone Creek projects involve production of onshore gas reserves. As they are both onshore gas projects located more than 10 miles from the proposed project, cumulative impacts from these projects is considered unlikely.

The Knik Arm Dredging Project and the Point Mackenzie Port Development are ongoing projects; major construction activities were scheduled to be completed in 2000. Both projects are located in the Knik Arm area, some 60 to 70 miles from the proposed project location. As such, cumulative impacts from these two projects are not anticipated.

The remaining Cook Inlet area projects listed on Table 4-1 are either distant from the proposed project location, have an undefined scope, and/or are believed unlikely to proceed at least within the near future (next 5 years).

4.2 GEOLOGY AND SOILS

Potential environmental impacts associated with geology and soils include: offshore sediment disturbance during pipeline placement; onshore terrain disturbance during construction of the onshore pipeline and production facility; gravel requirements for construction of the access road; and geologic hazards that could cause an oil or gas spill. Sections 4.2.1 through 4.2.3 describe potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are described in Section 4.2.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.2.5 and 4.2.6, respectively.

4.2.1 Impacts During Construction

Potential construction impacts related to geology and soils include nearshore and offshore sediment disturbance during pipeline placement, onshore terrain disturbance during construction of the onshore pipeline and production facility, and use of gravel resources for construction of the access road.

4.2.1.1 Nearshore Sediment Disturbance

The proposed project assumes that the nearshore pipeline will be placed by trenching through the intertidal/shallow subtidal area. The pipe trench will be constructed from a 150-foot barge using either a backhoe or clamshell, with a production rate of approximately 10 cubic yards per minute. Calculations made by Forest Oil (NCG 2001) indicate that while the trench is being constructed, it will remove seafloor sediments at a rate of about 4.5 ft^3/sec (10 yd^3/min). The total area or volume of nearshore sediment disturbance is not known, but impacts are likely to be short-term and minor. Increased turbidity is likely to result from trenching operations. Impacts on water quality associated with turbidity during construction are discussed in Section 4.5, Marine Water Quality.

An alternate method for nearshore pipeline placement is auguring through the intertidal/shallow subtidal area. Augering would be conducted from the top of the bluff, and therefore impacts on nearshore sediments would be avoided. An engineering evaluation of whether augering is a technically viable option has not been completed by Forest Oil (NCG 2001).

4.2.1.2 Offshore Sediment Disturbance

The underwater pipeline can be placed using pipe pulling operations or a lay barge. Common offshore pipe pulling operations include assembly of the pipeline onshore and pulling the pipeline out to the platform. As sections of the line are welded and inspected, the pipeline is pulled towards the platform through the use of a temporary winch system at the platform. A barge may be required at the platform location to assist with pulling operations. In shallower water, pipelines may be placed in trenches constructed using backhoes or clamshells. The proposed project does not include burial of offshore portions of the pipeline, but does include burial of the shore approach using either track or barge-mounted backhoes to a water depth of -10 feet MLLW.

The pipe pull method is viable only for the proposed project. Impacts associated with pipe pull operations would include bottom disturbances due to the effects of the pull cables and pipelines physically being dragged on the seafloor. Estimated impacts from this operation would be limited to a seafloor corridor about 50 feet wide, for a total disturbed seafloor area of about 10 to 12 acres. Increased turbidity could also occur near the seafloor. The duration of disturbance using this method is expected to be on the order of several days (Amundsen 2000b). Overall, these effects would be short-term and minor.

The pipe lay barge methods is viable for the proposed project, and is the only technically feasible means to construct either Alternative 2 or 3. Impacts associated with use of a pipe lay barge would include physical disturbances to the seafloor resulting from dragging a stinger (frame structure that guides the lines from the lay barge to the seafloor) across the seafloor, and from placement and setting of the large anchors necessary to position the lay barge. It is estimated that eight anchors would be required on the barge (Amundsen 2000b). Anchors would be periodically repositioned as the barge moves offshore, and actual seafloor disturbance would result as the anchor cables are pre-tensioned. Seafloor impacts would likely not cover a larger area per unit distance than the pipe pull method, but effects would be spread out over a corridor possibly 1,000 to 2,000 feet wide (primarily due to anchoring). Increased turbidity could also occur near the seafloor. The duration of disturbances using this method is expected to be about one week (Amundsen 2000b). Associated impacts to the marine environment are expected to be both short-term, as recolonization of the disturbed substrate would rapidly occur.

4.2.1.3 Onshore Terrain Disturbances

Terrain disturbances will result from construction of an access road and pipelines through 1.8 miles of undisturbed area from the bluff at the West Foreland to the proposed Kustatan Production Facility. Potential impacts are primarily on wetlands and terrestrial habitat and are discussed in Section 4.9 (Terrestrial Biological Resources).

4.2.1.4 Gravel Resources Required

Approximately 29,000 cubic yards of gravel will be required to construct the proposed production pad, and 7,000 cubic yards will be required to construct the 1.8-mile access road between the Kustatan Production Facility and the tip of the West Foreland. Gravel resources have tentatively been identified by Forest Oil on Native-owned land near the general area (NCG 2001). Some positive benefits will accrue to the Native landowners from the sale of gravel, and any adverse impacts are expected to be minor.

4.2.2 Impacts During Normal Operations

No potential environmental impacts related to geology and soils due to normal operations have been identified.

4.2.3 Accidents and Natural Disasters

Potential impacts related to accidents and natural disasters include damage during seismic events, volcanic eruptions, and other geological hazards.

The proposed project lies within a region of high seismic activity; however, there are no known active faults located at any of the onshore or underwater facilities or pipelines. The Osprey Platform is designed to withstand anticipated API Zone 4 earthquake loadings (NCG 2001). The proposed new pipelines will also be designed to meet or exceed stringent seismic design criteria for the region. Subsequently, potential impacts from seismic activity are considered to be negligible, given current design technology.

Volcanoes may occur some time during the 20-year life of the proposed project. Eruptions and ash clouds normally would require the platform and production facilities to shut down operations while this condition exists. Ash falls are not considered a major danger; however, the abrasive and corrosive effects could be a nuisance to oil and gas operations (Hampton 1982). In addition, lava flows, pyroclastic, or debris flows should be considered a potential hazard to any coastal facilities located near an active volcano (MMS 1995).

Other geological hazards that can pose engineering challenges to facilities and pipelines include liquefaction, landslides, debris flow, rock falls, or other forms of soil instability. These conditions are not known to occur in the project area. As such, these factors would result in no impacts.

High currents in Cook Inlet may result in the formation of wave-like bottom features, which are somewhat mobile and could create long spans of unsupported pipe and therefore increase the risk of pipeline failure. Impacts related to pipeline failure are discussed in Section 4.4 (Physical Oceanography) and Section 4.5 (Marine Water Quality).

If a high pressure natural gas deposit is encountered during drilling, a blowout could occur, resulting in releases of oil and gas to the marine environment. Environmental impacts related to blowouts are discussed in Section 4.5 (Marine Water Quality).

Due to the stringent design criteria, and the relatively unlikely event of a major natural disaster during the life of the project, potential environmental impacts from the proposed project related to geological hazards are considered minor.

4.2.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Potential impacts associated with construction activities would be comparable to the proposed project, with the exception that the underwater pipeline would be 3.3 miles, rather than 1.8 miles. Thus, a larger area of the seafloor would be disturbed during pipe lay barge operations. Pipe trenching activities would result in similar impacts as for the proposed alternative. Construction impacts associated with Alternative 2 are expected to be short-term and minor. The potential for pipeline damage and subsequent releases of crude oil to the marine environment are greater for Alternative 2 than for the proposed project. Side scan sonar surveys of the pipeline routing for Alternative 2 discovered the presence of a significant boulder bed (NCG 2001) that would significantly impact placement of the pipeline along this route. In addition, the underwater pipeline for this alternative is 80 percent longer than the proposed project. Gravel requirements for Alternative 2 (offshore pipeline to Kustatan) will be less than 29,000 cubic yards to construct the proposed production facility pad. This is comparable to and somewhat less than the gravel requirements for the proposed project, and therefore impacts are believed to be minor.

Alternative 3 (Offshore Pipeline to Trading Bay). Potential impacts associated with construction activities would be comparable to the proposed project, with the exception that the underwater pipeline would be 10.5 miles, rather than 1.8 miles. Thus, a larger area of the seafloor would be disturbed during pipe lay barge operations. Pipe trenching activities would result in similar impacts as for the proposed alternative. Impacts associated with Alternative 3 are expected to be short-term and minor. The potential for pipeline damage and subsequent releases of crude oil to the marine environment are greater for Alternative 3 than for the proposed project. The 10.5 mile pipeline is significantly longer than for the proposed project; no surveys have been performed along this route and therefore the risks are unknown.

Alternative 3 (offshore pipeline to Trading Bay) would involve minimal gravel requirements and would result in negligible impacts.

Alternative 4 (No Action). No seafloor would be disturbed or turbidity generated under this alternative. No pipelines would be constructed under this alternative; therefore there is no potential for pipeline damage. Alternative 4 (the no action alternative) would have no associated impacts.

Potential environmental impacts related to geological hazards are similar for Alternatives 2 and 3, and are believed to be negligible to minor. Alternative 4 (no action) would result in no environmental impacts due to geological events.

4.2.5 Cumulative Impacts

Because impacts to soil and sediment would occur on a very localized level (e.g., in the immediate project vicinity), the contribution of the proposed project to cumulative impacts on soil/sediment is negligible. In the event of a major geologic event (e.g., earthquake, volcanic eruption), potential releases from the proposed project could contribute to overall environmental impacts in the Cook Inlet region. However, given that there are currently 15 other offshore oil and gas production platforms and supporting operations (including 500 miles of underwater pipeline) in the upper Cook Inlet, the proposed project (one platform, 7 additional miles of pipeline) would not add significantly to the potential cumulative effects from a major geologic event.

4.2.6 Mitigation Measures

The following mitigation measures will minimize the potential for environmental impacts related to geology and soils:

- Preplacement side-scan sonar and shallow sub-bottom geophysical surveys to avoid boulder or rocky areas to the extent possible.
- Shallow borings to determine whether the intertidal segment can be placed by boring (preferred) rather than by trenching.
- Use of current industry standards for pipelines/utilities in locations such as Cook Inlet.
- Burial of the pipeline in the intertidal and shallow subtidal areas.
- Use of periodic side scan sonar surveys (at least every 2 years) to inspect the integrity of the pipelines and conduct remedial actions (typically sandbagging) if potential problems (i.e., excessive spans or impingement on boulders) are observed.
- Use of standard erosion control measures for access roads.

4.3 METEOROLOGY AND AIR QUALITY

4.3.1 Meteorological Impacts

Potential environmental impacts related to meteorological conditions are associated with severe weather events. Potential impacts during construction include weather delays during pipelaying operations (onshore construction operations are relatively insensitive to weather conditions). This could require suspension of portions or all of the activities until the weather conditions improve.

Severe winds or extreme low temperatures could result in damage to the Osprey Platform, potentially resulting in a release of oil or other materials to marine surface water. The platform was designed to withstand winds of 80 mph (Table 2-1); wind speeds of this magnitude have a return frequency of about 100 years, as estimated for the Anchorage International Airport. Similarly, the platform is designed for a minimum ambient air temperature of –20°F; the January mean minimum temperature at Kustatan (1999 to 2000) was 11.1°F. Therefore it is unlikely that severe winds or low temperatures would damage the Osprey Platform under any of the alternatives considered in this EA.

4.3.2 Impacts on Air Quality

Impacts on air quality could occur during construction, normal operations, and under accident conditions.

4.3.2.1 Impacts During Construction

Increased air emissions are expected during construction/installation of onshore and offshore project components. For the proposed project (Alternative 1), emissions will include air pollutants from fossil-fueled vehicles (increased truck traffic, operation of heavy equipment necessary for pipelaying operations, and offshore support vessels) and particulate matter (PM) from disturbance of the earth (grading, dozing, etc.). These emissions will be short-term (less than two months for onshore operations and less than five months for offshore operations) and minor.

4.3.2.2 Impacts During Normal Operations

For the purposes of this analysis, the following criteria have been established to assess the possible magnitude of impacts:

- Negligible: less than 100 tpy of emissions of any regulated pollutant
- Minor: 100 to less than 250 tpy of emissions of any regulated pollutant
- Moderate: 250 tpy or more emissions of any regulated pollutant and no adverse decrease in visibility at Tuxedni Wilderness Area
- Major: 250 tpy or more emissions of any regulated pollutant and an adverse decrease in visibility at Tuxedni Wilderness Area

The break between minor and moderate is generally taken as the applicability threshold for a PSD permit (250 tpy of any regulated pollutant). Although the PSD permits carry the designation of a “major” source per EPA and ADEC air quality regulations, this assessment is made on the basis of possible impacts.

Air quality impacts from the proposed project would be due to pollutants, primarily NO_x and CO, emitted during the combustion of fossil fuel to support drilling and production operations at the Osprey Platform and the Kustatan Production Facility. Emissions sources would include generators and boilers, for example. The proposed facilities are still being designed; however preliminary emission estimates have been prepared for the proposed project (HCG 2001a, b) and are presented in Table 4-4.

Based upon information provided in the Air Quality Construction Permit applications for the Osprey Platform and the Kustatan Production Facility (HCG 2001a, b), the Alaska State Implementation Plan (SIP)-approved PSD regulations, and EPA’s PSD guidance documents, the Osprey Platform and Kustatan Production Facility are considered a single “facility” under the Alaska SIP-approved PSD regulations. Further clarification of this issue is provided in Appendix G.

Because the two sources are considered one facility under the PSD regulations, their combined emissions were compared to the PSD applicability threshold of 250 tpy. As shown in Table 4-4, the potential emissions of all criteria pollutants resulting from the combined activities of the onshore and offshore sources operating as defined in the proposed project are predicted to be below the 250 tpy PSD applicability threshold.

Forest Oil is proceeding with monitoring and evaluations assuming that ADEC construction air permits will be required but that a PSD permit will not be required.

Dispersion modeling in support of the ADEC construction air permit applications has been conducted. Based on a review of the dispersion modeling assumptions and results, ADEC has determined that Forest Oil has adequately demonstrated compliance with the NO_2 and CO National Ambient Air Quality Standards (NAAQS) (Appendix G).

Based on the above criteria and discussions, normal operating conditions for the proposed project are predicted to pose a minor impact on air quality.

4.3.2.3 Accidents

Potential impacts to air quality associated with accidents could result from an upset such as an explosion or large release of crude oil, which subsequently caught on fire. Such an event would be rare, however, and the probability of its occurrence is difficult to calculate. The air quality impacts from such an event would be short-term and temporary.

4.3.2.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Emissions resulting from construction under Alternative 2 are predicted to be roughly the same as those from the proposed project. The onshore pipeline would be much shorter (i.e., less than 1,000 feet), which would result in lower PM emissions than those expected under the proposed project. Emissions during normal operations for Alternative 2 would be the same as for the proposed project, as the same equipment would be operated both at the Osprey Platform and the Kustatan Production Facility under both scenarios. Under Alternative 2, potential emissions of all criteria pollutants are predicted to be below the 250 tpy PSD applicability threshold for the combined activities of the onshore and offshore facilities operating as defined in this alternative. Alternative 2 is predicted to pose a minor impact on air quality.

Alternative 3 (Offshore Pipeline to Trading Bay). Emissions from Alternative 3 would be lower since there would be no construction of an offshore production facility. Emissions during normal operations would be the same or slightly lower than from the proposed project and Alternative 2. The majority of predicted air pollutant emissions are the result of producing the necessary power to pump and treat the crude oil, and are directly proportional to the throughput of crude to be handled and distance to be pumped. Ancillary sources at the onshore facility, such as for lighting, fire pumps, and comfort HVAC, are minor sources in comparison. Since the amount of crude to be handled remains the same under Alternative 3, it is reasonable to predict that the Trading Bay Production Facility would need to increase consumption of fossil fuels to handle the crude from the Osprey platform, and air pollutant emissions would be similar or less than those predicted for the proposed project (NCG 2001). Under Alternative 3, only the platform emissions would be considered in determining PSD applicability, and emissions of all regulated air pollutants fall below the established thresholds. Alternative 3 is predicted to pose a minor impact on air quality from the Osprey Platform, and a minor impact on air quality at Trading Bay.

Alternative 4 (No Action). No construction or normal operations would take place, and therefore no air emissions would occur. This alternative would have no impacts on air quality.

4.3.2.5 Cumulative Impacts

The total emissions from the platform/onshore production facility represent a relatively small percentage of the total emissions for the general region (less than 2 percent of the total emissions within a 55 kilometer radius of the platform during the exploration phase; Hoefler 1999). Since ambient levels of regulated air pollutants in the project vicinity are well below the applicable NAAQS, the proposed project is not expected to contribute significantly to cumulative air quality impacts.

4.3.2.6 Mitigation Measures

Appropriate mitigation measures include:

- Development of an air monitoring program.
- Use of best available technology to minimize emissions from the platform and the onshore production facility.

4.4 PHYSICAL OCEANOGRAPHY

Potential environmental impacts associated with physical oceanography include: increased turbidity during pipeline placement; and pipeline damage related to currents, waves, and ice. Sections 4.4.1 through 4.4.3 describe potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are described in Section 4.4.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.4.5 and 4.4.6, respectively.

4.4.1 Impacts During Construction

Potential construction impacts related to physical oceanography include increased turbidity during pipeline placement. Strong currents in the vicinity of the platform will result in rapid dispersion of suspended sediments, however. Increased turbidity as a result of construction operations is discussed further in Section 4.5 (Marine Water Quality).

High winds, waves, ice presence, and possibly fog could delay construction operations and result in increased environmental disturbance. Construction activities will be conducted during the summer and fall when weather conditions are likely to be good and ice is not present in the upper inlet. Associated impacts on the marine environment due to project construction are expected to be short-term and minor.

4.4.2 Impacts During Normal Operations

No potential environmental impacts related to physical oceanography during normal operations have been identified. Potential pipeline damage due to current effects is discussed in the following section.

4.4.3 Accidents

Environmental impacts related to physical oceanography are associated primarily with the potential for pipeline damage and subsequent releases of crude oil and gas.

Oil and gas pipelines have been operating in upper Cook Inlet, both north and south of the proposed pipeline route, since the mid-1960s to early 1970s (Belmar 1993). A total of about 525 miles of pipeline were placed in about 270 miles of pipeline corridor mostly between 1965 and 1974 (one line was laid in 1986). Pipeline diameters range between 4 and 10 inches. Problems with these pipelines have primarily been associated with suspension of pipelines that lie in sand and gravel wave areas, and impingement of boulders on pipelines. The potential for damage from vessels dragging anchors across pipelines also exists.

Based on preliminary information, the proposed underwater pipeline may cross sand and gravel waves; however, the waves are likely to be of relatively low amplitude due to the water depths and proximity to shore. Based on experience with other pipelines in the area, there is a general concern when long sections of pipeline (typically 50 feet or more) become suspended between the sand and gravel waves (NCG 2001). The specific concern is that currents will tend to induce vibrations in the lines that could lead to fatigue failure in the line. From 1965 to 1983, there have been 15 reported pipeline failures in Cook Inlet. Two of these failures were associated with failure of the marine riser at the platform, and the others were associated with failures due to pipeline suspensions. One other failure occurred in 1987 in the Granite Point area, and was a result of abrasion from a suspended portion of the pipeline resting on a rock outcrop. Pipeline suspensions in existing routes are determined through side scan sonar surveys conducted every 1 to 2 years. Remediation efforts typically used to correct the problem include placement of sandbags in the more prominent sections of suspension (using diver support).

The periodic surveys also occasionally detect large boulders or debris resting on or next to a pipeline. As indicated above, at least one pipeline failure occurred as a result of pipeline abrasion occurring in conjunction with a suspension. In these cases, sandbags would also be used to stabilize the object and pipeline.

An occasional problem that can occur is the dragging of anchors across pipelines. Of particular concern are larger vessels (tankers, cargo ships, etc.) that travel through the area. Under normal circumstances, there would not be any reason for the larger vessels to drag their anchors in the area; pipeline corridors are marked on nautical charts for the area. Smaller vessels have been known to occasionally drag anchors across lines, but these seem to have little effect on the lines (NCG 2001).

Although ice forces on pipelines are normally less than those imposed by conditions as discussed above, ice is normally a consideration for pipelines in Cook Inlet. The primary concern would be abrasion or damage to coatings the pipeline may have to minimize corrosion. As a general practice, pipelines have been buried in the intertidal and shallow subtidal areas to prevent impingement of ice on the pipeline.

With proper design and maintenance, pipelines for the proposed project can be operated in Cook Inlet with minor impacts. The proposed pipeline routing avoids boulders and other features that could result in pipeline suspensions. Mitigation measures to minimize the potential for pipeline damage will be employed as described in Section 4.4.6. If a pipeline rupture did occur, up to 1,633 barrels (70,000 gallons) of crude oil could be released to the marine environment (NCG 2001). Environmental impacts related to pipeline rupture accidents are discussed in more detail in Section 4.5, Marine Water Quality.

4.4.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Potential impacts associated with construction activities would be comparable to the proposed project, with the exception that the underwater pipeline would be 3.3 miles, rather than 1.8 miles. Thus, a larger area of the seafloor would be disturbed (and increased turbidity generated) during pipeline placement operations. Construction impacts associated with

Alternative 2 are expected to be short-term and minor. The potential for pipeline damage and subsequent releases of crude oil to the marine environment are greater for Alternative 2 than for the proposed project. Side scan sonar surveys of the pipeline routing for Alternative 2 discovered the presence of a large boulder bed (NCG 2001) that would significantly impact placement of the pipeline along this route and increase the risks of pipeline damage. In addition, the underwater pipeline for this alternative is 80 percent longer than the proposed project.

Alternative 3 (Offshore Pipeline to Trading Bay). Potential impacts associated with construction activities would be comparable to the proposed project, with the exception that the underwater pipeline would be 10.5 miles, rather than 1.8 miles. Thus, a larger area of the seafloor would be disturbed during pipeline placement. The potential for pipeline damage and subsequent releases of crude oil to the marine environment are greater for Alternative 3 than for the proposed project. The 10.5 mile pipeline is significantly longer than for the proposed project; no surveys have been performed along this route and therefore the risks are unknown.

Alternative 4 (No Action). No seafloor would be disturbed or turbidity generated under this alternative. No pipelines would be constructed under this alternative; therefore there is no potential for pipeline damage.

4.4.5 Cumulative Impacts

Pipeline spills and leaks from the proposed project could contribute to cumulative impacts on the marine environment in central Cook Inlet. If a major pipeline rupture occurred, a maximum of 1,633 barrels of crude oil would be released. The probability of such a rupture is very low (see Section 4.1.4). Smaller leaks and spills are more likely but would not contribute significantly to cumulative impacts on the marine environment in the general vicinity of the project or in Cook Inlet.

4.4.6 Mitigation Measures

The following mitigation measures will be employed by Forest Oil to minimize the potential for pipeline damage (NCG 2001):

- Preplacement side-scan sonar and shallow sub-bottom geophysical surveys to avoid boulder or rocky areas to the extent possible.
- Shallow borings to determine whether the intertidal segment can be placed by boring (preferred) rather than by trenching.
- Use of current industry standards for pipelines/utilities in locations such as Cook Inlet.
- Burial of the pipeline in the intertidal and shallow subtidal areas.
- Use of periodic side scan sonar surveys (every 2 years) to inspect the integrity of the pipeline and conduct remedial actions (typically sandbagging) if potential problems (i.e., excessive spans or impingement on boulders) are observed.

4.5 MARINE WATER QUALITY

Impacts on marine water quality can occur as a result of sediment disturbance during construction activities, discharges from the Osprey Platform during normal operations, and from releases during accident conditions (e.g., oil spills). Sections 4.5.1 through 4.5.3 describe potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are described in Section 4.5.4.

Cumulative impacts and applicable mitigation measures are identified in Sections 4.5.5 and 4.5.6, respectively.

4.5.1 Impacts During Construction

Nearshore and offshore pipeline placement will cause disturbance of sediment and a resultant increase in turbidity. In particular, trenching through the intertidal/shallow subtidal area will result in increased suspended sediment concentrations. The magnitude of possible suspended sediment concentrations resulting from the nearshore pipeline trenching was estimated by assuming the following general conditions during the operation:

- the trench is constructed from a 150-foot barge using either a backhoe or clamshell with a production rate of approximately 10 cubic yards per minute;
- the water depth is 5 feet; and
- seabed materials contain 5 percent fines by volume that could be suspended during the plow operations (most materials are expected to be sand, gravel and cobble-sized materials).

Investigations by Dames & Moore (1978) and NORTEC (1981) suggest that in a situation such as this, the physical presence of a construction barge and operating equipment is sufficient to result in the formation of a turbulent wake downcurrent of the plow, and that suspended sediments can be estimated using principles of wake theory. In addition, concentrations would be reduced by downcurrent deposition, but have been ignored in this application in order to produce conservative estimates of impacts.

Calculations made by Forest Oil (NCG 2001) indicate that while the trench is being constructed, it will remove seafloor sediments at a rate of about 4.5 ft^3/sec (10 yd^3/min). Assuming 5 percent fines (suspendable materials) and assuming that all fines will become suspended, sediment discharge rates will be on the order of 0.23 ft^3/sec.

The dimensions of the turbulent wake are expected to remain constant at all current speeds (NORTEC 1981) and would have a general cone-like appearance that increases in height at an angle of about 10 to 15 degrees. Actual concentrations within the wake will be dependent on the actual ambient current speeds. Table 4-5 summarizes predicted downcurrent suspended sediment concentrations under a general range of currents anticipated in the general construction area.

As indicated in Table 4-5, increased suspended sediment concentrations at a downcurrent distance of 1,000 feet will be less than 50 mg/L at 1-knot currents (and less at higher currents). These effects are short-term and are anticipated to occur only during actual construction activities.

As inferred from the results of studies by Lees et al. (1999), sediments along all proposed pipeline routes are expected to be free of man-made contaminants, including hydrocarbons from petrogenic sources. As such, possible adverse effects from turbidity plumes would be associated only with physical effects from increased turbidity. Given the naturally high ambient turbidity, impacts of the proposed project are expected to be short-term and minor.

Placement of the underwater portion of the pipeline using either the pipe pulling or lay barge methods will result in increased turbidity near the seafloor due to dragging of cables, pipelines, and anchor placement. Associated impacts are expected to be short-term (up to one week) and minor.

Additional impacts on marine water quality during construction could occur as a result of minor oil spills. Minor spills (typically 50 barrels or less) could occur from barges and support vessels used during platform and pipeline construction/placement. Impacts on water quality related to oil spills are discussed in Section 4.5.3.

4.5.2 Impacts During Normal Operations

Discharges from the proposed project will include deck drainage, sanitary wastes, domestic wastes, boiler blowdown, fire control system test water, non-contact cooling water, and excess cement slurry. These waste streams are described in Section 2.2.1.8. Wastes will be discharged from the Osprey Platform in accordance with an NPDES permit for which an application has been submitted to EPA (Appendix A). Waste stream volumes and characteristics are presented in Table 4-6.

4.5.2.1 Sanitary Waste Discharges

One potential impact of the sanitary waste discharge is the possible reduction in ambient dissolved oxygen concentrations in the receiving waters when sanitary waste is discharged (Tetra Tech 1994). The dissolved oxygen standard for aquatic life is usually 6 mg/L (Jones and Stokes 1989), while the ambient dissolved oxygen in the receiving waters of Cook Inlet is assumed to be higher than 8 mg/L (EPA 1984). In an analysis of a worst case scenario, EPA (1984) concluded that the discharge of treated sewage effluent during offshore exploratory drilling should not significantly impact aquatic life when ambient dissolved oxygen concentrations are at least 1 mg/L above the dissolved oxygen standard for aquatic life of 6 mg/L. Because the sanitation device is an aerated system capable of providing a minimum of 2,100 cubic feet of air per pound of BOD, dissolved oxygen in the effluent is anticipated to meet this requirement when the system is properly operated in accordance with the operating manual (UIG 1998).

The effluent is anticipated to contain average concentrations of total suspended solids (TSS) of less than 50 mg/L (Amundsen 2000b). This concentration is less than the daily maximum concentrations permitted for sanitary discharges from the oil and gas production platforms in Cook Inlet that operate under the NPDES General Permit (EPA 1999). Operated properly, TSS of the Osprey Platform sanitary discharge will be less than the ambient TSS in Cook Inlet of 100 mg/L (Brandsma 1999).

The wastewater will be chlorinated to remove fecal coliform (FC) bacteria. Effluent from the clarifier will flow through a chlorinator and into a 65-gallon chlorine detention tank where chlorine will dissipate for 30 minutes to an hour. Operated in accordance with the operating manual, the chlorine will reduce the fecal coliform bacteria to levels at or below the Alaska Water Quality Standard of 14 FC/100 ml.

The NPDES General Permit for Oil and Gas Production Platforms in Cook Inlet (EPA 1999) requires a total residual chlorine concentration of at least 1 mg/L to ensure proper disinfection of the sanitary waste without causing harm to the aquatic life. In the case of the Osprey Platform sanitary waste, it appears that sodium sulfite will be used to dechlorinate the effluent in-line immediately prior to discharge (UIG 1998). The sodium sulfite reacts with free and residual chlorine instantaneously, consuming a small amount of alkalinity (1.38 mg of $CaCO_3$/ml chlorine consumed) (UIG 1998). The concentration of total residual chlorine in the final effluent is anticipated to be less than or equal to 2 ug/L (Amundsen 2000b). Thus the water quality standards for residual chlorine will be met at the end-of-pipe, causing no direct or indirect impacts on aquatic life.

In addition to meeting water quality standards or anticipated NPDES effluent limits, the sanitary wastewater from the Osprey Platform will be discharged to a section of Cook Inlet which has been demonstrated to be a non-depositional, high-energy environment characterized by a cobble and sand

bottom. Fast tidal currents and tremendous mixing produce rapid dispersion of the minimal concentrations of soluble and particulate pollutants. Brandsma (1999) determined that the high suspended solids discharge of drilling muds would be reduced more than two orders of magnitude within 100 meters under the least turbulent conditions, and three orders of magnitude under more turbulent conditions. It is expected that pollutants in the sanitary waste will be dissipated to undetectable concentrations within a few feet of the discharge.

4.5.2.2 Other Waste Streams

Oil is the primary pollutant found in deck drainage, with concentrations estimated at 24 to 450 mg/L (EPA 1996). Other potential contaminants include detergents and spilled drilling fluids. Contaminated deck drainage will be treated through an oil-water separator prior to discharge and will be required to meet state water quality standards. Therefore, no adverse impacts on water quality are anticipated to result from discharge of deck drainage.

Domestic waste, which may contain kitchen solids and trace amounts of detergents, cleansers, and oil and gas, does not represent a significant discharge flow. Potential effects of domestic waste discharges are difficult to determine given the absence of analytical data, but are expected to be minimal.

Non-contact cooling water is not significantly different in composition than ambient seawater, except for an elevated temperature (estimated at 62° to 84°F; EPA 1996). Forest Oil's permit application indicates that non-contact cooling water will be discharged at an average temperature of less than 60°F, with a maximum daily value of 70°F, and therefore no environmental impacts are anticipated.

Boiler blowdown and fire control system test water are intermittent discharges that will be treated through an oil-water separator to remove oil and grease. No adverse impacts on water quality are anticipated due to these discharges.

Excess cement slurry represents another intermittent discharge. This waste stream may contain up to 200,000 mg/L of total suspended solids (daily maximum). The pH may be as high as 12, with temperatures up to 80°F and oil and grease up to 50 ppm (Amundsen 2000a). Although the exact composition of the cement is not documented, given the small waste volume and intermittent nature of the discharge, it is not expected to represent a significant pollution source and is not likely to result in adverse impacts.

Based on the above discussions, impacts on water quality of discharges from the proposed project during normal operations are considered to be negligible to minor. Potential impacts on marine biota and threatened and endangered species are discussed in Section 4.7 and 4.8, respectively.

4.5.3 Accidents

The largest potential environmental consequences resulting from an accident are associated with oil spills. Potential sources, volumes, and likelihood of oil spills are described in Section 4.1.4. Offshore oil spills could range in size from a small pipeline or diesel fuel spill, to 50,000 barrels or more from a well blowout (NCG 2001). Based on industry averages, spills of greater than 50 barrels are not expected to occur during the life of the proposed project. An average of approximately 12 smaller spills (i.e., less than 50 barrels) would be anticipated to occur (assuming a total production of 50 million barrels and a 30-year project life).

Oil spilled on the water would be subject to both weathering and advection. The spill would spread horizontally in an elongated pattern oriented in the direction of wind and currents and non-uniformly into thin sheens (0.5 to 10 µm) and thick patches (0.1 to 10 mm) (MMS 1996b). In cooler waters such as Cook Inlet, oil spills spread less and remain thicker than in temperate waters due to differences in oil viscosity. The presence of broken ice would also tend to retard spreading.

Evaporation results in the preferential loss of lighter, more volatile hydrocarbons, increasing their density and viscosity. Evaporation of volatile components can account for 30 to 50 percent of crude oil spill loss, with approximately 25 percent occurring in the first 24 hours (MMS 1996b). The initial evaporation rate increases with increasing winds, temperatures, and sea conditions. Evaporative processes occur on spills even in ice-covered waters, although at a slower rate. Diesel fuel evaporates more slowly than crude oil, with approximately 10 to 15 percent evaporating within 40 hours (at 23°C). However, a larger percentage overall of diesel fuel will eventually evaporate (MMS 1996b).

Dispersion results in the loss of soluble, low-molecular-weight (LMW) aromatics such as benzene, toluene, and xylenes. The LMW aromatics, which are acutely toxic, rapidly dissolve into the water column; however, dissolution is very slow compared to evaporation and most volatiles usually evaporate rather than dissolve. Dissolved hydrocarbon concentrations beneath an oil spill therefore tend to remain less than 1 part per million (MMS 1996b).

Emulsification results from incorporating water droplets in the oil phase and generally is referred to as mousse. Mousse formation is promoted by water turbulence such as induced by wave action. Mousse formation increases the viscosity, specific gravity, spreading characteristics, and slows the subsequent weathering process (MMS 1996b).

Oil spills are additionally affected by the presence of high suspended sediment concentrations such as occur in the upper inlet. It is believed that oil adheres to sediment particles, thereby increasing its density and eventually sinking. In a number of spills in the upper inlet, surface slicks have not been observed after several days.

In addition to the changes in physical characteristics as outlined above, offshore spills from the proposed operation can be rapidly transported by winds and currents. Strong tidal currents alone can transport oil 20 to 25 miles in a single tidal excursion. According to modeling performed by Forest Oil (NCG 2001), after one day, a platform spill could be located anywhere between the North Forelands to the north and the southern tip of Kalgin Island to the south. After 3 days, the spill could be located nearly anywhere within Cook Inlet. At the end of 15 days, most remaining oil would be on the beach with some possibly remaining in tidal rips in the lower inlet. Areas most heavily impacted from a major platform spill would be the west side of the inlet between Harriet Point at the south end of Redoubt Bay (including Kalgin Island) northward to the vicinity of the North Forelands. On the east side, most likely impacted areas would be from the East Foreland southward to the general Ninilchik area.

As discussed in Section 4.1.4, industry data indicate that there is some potential for oil spills associated with the proposed project. If a major oil spill were to occur, potential environmental impacts could be significant. However, the probability that a major spill will occur is low and impacts on water quality would be short-term (e.g., less than 3 years). In addition, mitigation measures described in Section 4.5.6 would help reduce the potential impacts on water quality. Smaller spills, which are more likely to occur during the life of the project, could result in minor to moderate impacts on water quality. Specific impacts from oil spills are further discussed for individual impact areas in the remainder of Section 4.0.

4.5.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Impacts due to construction and normal operations would be similar to the proposed project, since discharges from the Osprey Platform are the same in both cases. This alternative would have a slightly higher probability of an oil spill due to an underwater pipeline rupture/leak, because of the increased length of the pipeline. Based on extrapolations performed by Forest Oil (NCG 2001), under this alternative, the probability of a major pipeline rupture would be about twice that of the proposed project.

Overall, impacts from Alternative 2 are expected to be minor to moderate for construction and normal operations. If a major oil spill were to occur, potential environmental impacts could be significant. However, the probability that a major spill will occur is low and impacts on water quality would be short-term. In addition, mitigation measures described in Section 4.5.6 would help reduce the potential impacts on water quality. Smaller spills, which are more likely to occur during the life of the project, could result in minor to moderate impacts on water quality.

Alternative 3 (Offshore Pipeline to Trading Bay). Impacts due to construction and normal operations would be similar to the proposed project, since discharges from the Osprey Platform are the same in both cases. This alternative would have a slightly higher probability of an oil spill due to an underwater pipeline rupture/leak, because of the increased length of the pipeline. Based on extrapolations performed by Forest Oil (NCG 2001), under this alternative, the probability of a pipeline rupture would be about six times greater than for the proposed project. Overall, impacts from Alternative 3 are expected to be minor to moderate for construction and normal operations. If a major oil spill were to occur, potential environmental impacts could be significant. However, the probability that a major spill will occur is low and impacts on water quality would be short-term. In addition, mitigation measures described in Section 4.5.6 would help reduce the potential impacts on water quality. Smaller spills, which are more likely to occur during the life of the project, could result in minor to moderate impacts on water quality

Alternative 4 (No Action). No impacts on water quality would be anticipated under the no action alternative.

4.5.5 Cumulative Impacts

Other discharges of similar quality in Cook Inlet include: sanitary, domestic, deck drainage, and other waste discharges from oil and gas platforms in Cook Inlet; and municipal waste streams from Anchorage, Homer, Kenai, and other smaller cities. Given the minimal nature of the discharges from the Osprey Platform, its contributions to the cumulative loading in Cook Inlet are anticipated to be negligible. The volume and concentration of pollutants in the discharges from the Osprey Platform are expected to be minimal. All contaminants of concern will be discharged at concentrations that meet water quality criteria and the requirements of the General Permit (EPA 1999). In addition, the strong tidal fluxes associated with Cook Inlet and the West Foreland area will disperse discharges very rapidly (Haley et al. 2000). Thus, there would be no cumulative impacts on water quality from the discharges associated the Osprey Platform.

The discharges will meet human health water quality criteria at the end-of-pipe. These criteria are designed to protect humans from accumulation of harmful contaminant concentrations based on consumption of fish and shellfish. The discharges will also meet the water quality criteria at the end-of-pipe for protection of aquatic life. Monitoring is anticipated to be required by the NPDES permit that will be issued for the Osprey Platform to ensure compliance with the water quality standards. No water quality-based limits are needed to provide protection to aquatic life.

Wastewater from the Osprey Platform will be discharged to a section of Cook Inlet which has been demonstrated to be a non-depositional, high-energy environment characterized by a cobble and sand bottom. Fast tidal currents and tremendous mixing produce rapid dispersion of the minimal concentrations of soluble and particulate pollutants. Brandsma (1999) determined that the high suspended solids discharge of drilling muds would be reduced more than two orders of magnitude within 100 meters under the least turbulent conditions and three orders of magnitude under more turbulent conditions. Therefore, the minimal concentrations of TSS and BOD that will be discharged from the sanitary wastewater stream at the Osprey Platform are anticipated to be rapidly dissipated and have no potential cumulative impacts on water quality.

Cumulative impacts on water quality related to oil spills are believed to be minor. The proposed project would include operation of one additional offshore production platform and placement of about 7 additional miles of pipeline (3 pipelines) offshore. Currently there are 15 platforms and over 500 miles of offshore pipelines in operation in the upper Cook Inlet. Recent investigations on effects of Cook Inlet oil and gas operations indicate only a few (and extremely local) cumulative impacts on sediment and water quality from industry operations in the inlet (see also Section 4.1.4). Within the context of existing regional conditions, these would be neither unusual nor add significantly to potential cumulative effects from oil and gas operations in Cook Inlet.

4.5.6 Mitigation Measures

The following actions have been identified to minimize the potential for an oil spill and to mitigate potential impacts on water quality if a spill were to occur (NCG 2001):

- Monitoring to ensure compliance with water quality standards.
- Installation of overfill protection and secondary containment to mitigate potential diesel tank ruptures.
- Use of blowout preventers and monitoring of drilling mud weight to minimize the potential for a well blowout.
- Installation of a SCADA monitoring and control system.
- Internal and external monitoring of pipelines.
- Preparation and adherence to an ADEC-approved Oil Discharge Prevention and Contingency Plan (C-Plan). This plan will be formatted in accordance with ADEC regulations (18 AAC 75) and describes specific methods to prevent, detect, and respond to spills in the event they occur. The C-Plan will be prepared and approved prior to initiation of production operations.
- Preparation and adherence to Facility Response Plans (FRPs) for the Minerals Management Service (per 30 CFR 250 and 254), the Research and Special Programs Administration (per 49 CFR 194), and the U.S. Coast Guard (per 33 CFR 154) as required by the Oil Pollution Act of 1990. The FRPs will be incorporated into the ADEC C-Plan with appropriate cross-references.
- Preparation of a Spill Prevention Control and Countermeasure (SPCC) Plan as required by EPA (per 40 CFR 112) for both the Osprey Platform and the Kustatan Production Facility. The SPCC will also be incorporated into the ADEC C-Plan.
- Maintain membership in the Cook Inlet Spill Prevention and Response, Inc. (CISPRI), a federally-approved Oil Spill Removal Organization (OSRO). CISPRI currently maintains a response capability to handle in excess of a 50,000-barrel spill in Cook Inlet waters.

4.6 FRESHWATER RESOURCES

Potential environmental impacts on freshwater resources include erosion and sedimentation during construction, water supply requirements during production operations, and effects of oil spills on freshwater resources. Sections 4.6.1 through 4.6.3 describe potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are described in Section 4.6.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.6.5 and 4.6.6, respectively.

4.6.1 Impacts During Construction

Impacts on freshwater resources could occur during construction of the onshore production facility and the onshore pipelines/access road. Erosion and increased sedimentation may result from the use of large earth-moving equipment such as backhoes and bulldozers along the 1.8-mile corridor between the tip of the West Foreland and the Kustatan Production Facility and during the construction of the production facility itself. The facility is subject to the conditions of the NPDES General Permit for Storm Water Discharges from Construction Activities (63 FR 7858), and therefore Forest Oil must prepare a Storm Water Pollution Prevention Plan (SWPPP) to address potential construction impacts. Mitigation measures are discussed in Section 4.6.6.

The proposed onshore pipeline and access road will not cross any streams, but will pass through 772 lineal feet of wetlands. Use of sediment barriers in the vicinity of wetlands and other construction best practices (such as limited disturbance of the surficial organic soils and avoiding steep cuts) should be used to minimize erosion and sedimentation. Impacts on wetlands are discussed further in Section 4.9.

Construction impacts are anticipated to be short-term and minor.

4.6.2 Impacts During Normal Operations

The proposed Kustatan Production Facility will initially require up to 19,000 bbl of water per day to support water injection operations. The proposed source of water will be deep groundwater sources (from depths of about 12,000 feet) from the unsuccessful Tomcat Exploration Well. This well is located at the currently proposed location for the onshore production facility (e.g. the former Tomcat Exploration Well Site). This proposed water source is not considered to be potable water (due to high chloride concentrations) and is not hydrologically connected to the shallow potable water sources used for water supplies in the area (NCG 2001).

The closest known water well is located at the West McArthur River Unit (operated by Forest Oil), which is approximately 4.5 miles north of the proposed onshore production facility. There are no other known groundwater users within 5 miles of the proposed Kustatan site and no conflicts for water use are anticipated. Appropriate water rights and approvals must be obtained from the ADNR and the AOGCC for the water use.

Storm water runoff from the facility may result in the transport of pollutants to surface water. Potential mitigation measures are discussed in Section 4.6.6.

Overall, potential impacts on fresh water resources due to normal operations are expected to be minor for the proposed project.

4.6.3 Accidents

Spills from the onshore production facility (oil, produced water, or diesel fuel) or onshore pipelines could potentially impact surface water and ultimately shallow groundwater sources that may be used by the few local residents in the area. Private users in the immediate area may use water resources but they do not have water rights from the Alaska Department of Natural Resources (with the exception of Forest Oil) and as such little is known of specific sources and quantities used. It is expected that any water use is seasonal in nature. Potential impacts on shallow groundwater resources from a spill are expected to be minor.

Oil spills could also impact wetlands and the plants and animals that utilize wetland habitat. These impacts are discussed in Section 4.9.

4.6.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Potential impacts on freshwater resources would be comparable and slightly lower than for the proposed project. A much shorter onshore pipeline (i.e., less than 1,000 feet) would be constructed, and therefore erosion and sedimentation would occur primarily during construction of the Kustatan Production Facility. Water supply requirements would be the same as for the proposed project. Spills are less likely to occur under Alternative 2 because the 1.8-mile pipeline from the tip of the West Foreland would not be constructed; therefore, only spills from the onshore production facility and the short onshore pipeline could occur.

Alternative 3 (Offshore Pipeline to Trading Bay). Under this alternative, the Kustatan Production Facility and pipelines/access road would not be constructed. Water resources would be required from the vicinity of the Trading Bay Production Facility, and potential use conflicts could occur at this location (NCG 2001). Potential oil spill impacts would occur in the vicinity of Trading Bay, rather than the West Foreland area. Information on potential oil spill impacts on freshwater resources near Trading Bay was not available.

Alternative 4 (No Action). No construction or production operations would be conducted under Alternative 4, and therefore no impacts on freshwater resources would occur.

4.6.5 Cumulative Impacts

No cumulative impacts on freshwater resources are anticipated to occur due to the proposed project. Construction impacts would be localized and short-term. Although large quantities of groundwater will be required during production operations, no resource conflicts are known. Cumulative oil spill impacts are discussed in Section 4.9.

4.6.6 Mitigation Measures

Applicable mitigation measures include the following:

- Preparation and adherence to a Storm Water Pollution Prevention Plan (SWPPP) to mitigate impacts of erosion, sedimentation, and storm water runoff on freshwater resources.
- Use of best management practices (BMPs) to retain sediment on site to the extent practicable, including, as appropriate: (1) stabilization practices (e.g., establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of mature vegetation) and (2) structural practices (e.g., silt fences, earth dikes,

drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, reinforced soil retaining systems, temporary or permanent sediment basins).

- Use of BMPs to control pollutants in storm water discharges that will occur after construction operations have been completed, including, as appropriate: storm water detention structures, flow attenuation by use of open vegetated swales and natural depressions, and infiltration of runoff onsite.
- Use of sediment barriers and other construction techniques (e.g., limited disturbance of surficial organic soils and avoidance of steep cuts) in the vicinity of wetlands to minimize erosion and sedimentation.

4.7 MARINE BIOLOGICAL RESOURCES

Potential environmental impacts on marine resources are reviewed in this EA primarily at the population level, although impacts to individuals are also considered. Management is generally conducted at the population level, and although individuals may be affected by project activities, population-level effects should guide evaluation processes. Scientists typically study individual behavior, physiology, and health and extrapolate those findings to the population level to evaluate impact. The findings and their interpretation by resource managers are the key to appropriate evaluation of the impacts of any project. It is important to remember that population level effects are likely not as obvious as those observed in individuals, and there may be a time lag in a population's response to human activities. In addition, population responses may be masked due to natural variability in measurements and cumulative effects of actions over space and time.

Potential impacts on marine biological resources from the proposed project may occur as a result of construction activities (e.g., habitat disturbance and alteration, noise), normal operations (e.g., discharges from the Osprey Platform), and accidents (e.g., oil spills). Sections 4.7.1 through 4.7.3 describe the potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are described in Section 4.7.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.7.5 and 4.7.6, respectively.

4.7.1 Impacts During Construction

Environmental impacts on marine biological resources during construction may occur as a result of benthic habitat disturbance and noise impacts of construction activities.

4.7.1.1 Lower Trophic Level Organisms

Potential construction impacts are associated with the seafloor disturbance and increased turbidity from pipe laying operations for the underwater pipeline. Because of the highly energetic nature of the seafloor sediments, impacts are likely to be short-term in nature. Benthic communities in the upper inlet are generally sparse and naturally subjected to continual seabed movements. Assuming a disturbed seafloor area approximately 50 feet wide, a total of 11 acres of seafloor could be disturbed by the proposed project (a 1.8 mile long pipeline/utility corridor). Associated impacts are expected to be minor and short-term.

4.7.1.2 Fish

Because of naturally high suspended sediment concentrations and general lack of year-round food sources (Tarbox 1999; NCG 2001), the upper inlet has a relatively limited resident fish population. The Kustatan River and many of the other anadromous fish-bearing streams in upper Cook Inlet have significant

numbers of outmigrating salmon smolts and returning adult salmon nearshore. Eulachon also return to spawn in some of the rivers. Consequently, construction activities during this period could pose a significant threat to seasonal fish concentrations. If construction activities are timed to avoid impacts to migating fish, relatively low resident fish populations and the short-term nature of construction make significant impacts on fish unlikely.

4.7.1.3 Marine Birds

Human activities associated with construction of the Osprey Platform and Kustatan Production Facility, particularly air traffic near nesting waterfowl and seabirds, could reduce the productivity of local bird populations and may cause temporary abandonment of important nesting, feeding, and staging areas (MMS 1995). The responses of birds to human disturbance are highly variable. These responses depend on the species; the physiological or reproductive state of the birds; distance from the disturbance; type, intensity, and duration of the disturbance; and many other factors. The movement and noise of low-flying aircraft passing near seabird colonies often frightens most or all adult birds off their nests, leaving the eggs and young vulnerable to exposure, predation, and accidental displacement from the nest. Aircraft disturbance of waterfowl has been shown to cause lower nesting success of Pacific brant and common eider. Repeated air traffic disturbance of concentrations of feeding and molting waterfowl and shorebirds on coastal lagoons and other wetlands may reduce the ability of migratory birds to acquire the energy necessary for successful migration. Major known concentrations of marine birds are located at the Redoubt Bay Critical Habitat Area and the Trading Bay State Game Refuge. If construction activities are conducted during nesting periods, impacts on marine birds could be minor to moderate.

4.7.1.4 Marine Mammals

Baleen Whales. Construction activities during the summer months could result in increased aircraft and vessel traffic in Cook Inlet when a small number of cetaceans may be present in the inlet. Impacts will most likely result from noise produced by vessel and aircraft traffic and construction activities, and it is likely that activities will affect all of these species similarly. The levels, frequencies, and types of noise that will elicit a response vary between and within species, individuals, locations, and seasons. Behavioral changes may be subtle alterations in surface-respiration-dive cycles, more conspicuous responses such as changes in activity or aerial displays, movement away from the sound source, or complete avoidance of the area (Richardson et al. 1995). Due to low density and wide distribution of these species, construction is expected to have negligible to minor impacts on these whale populations.

Harbor Porpoise and Dall's Porpoise. Activities related to construction could potentially affect harbor and Dall's porpoises in Cook Inlet. Dall's porpoises dove, moved erratically, or rolled to look upward at an overflying Bell 205 helicopter at 215 to 365 m altitude (Withrow et al. 1985). Noise from construction activities is expected to cause only temporary, localized behavioral reactions to porpoises in Cook Inlet.

Killer Whale. There are no systematic studies examining the effects of noise on killer whales. However, there have been reports of short-term behavioral reactions to aircraft in toothed whales, such as turning away, abruptly diving, and looking towards the aircraft (Malme et al. 1989). Increased vessel traffic associated with construction should not cause any long-term impact on killer whales. Potential behavioral responses could include altering swimming speed and moving away from the noise source. Although construction and vessel activity may temporarily disturb killer whales, impacts are expected to be short-term and negligible.

Harbor Seal. Johnson et al. (1989) reported that harbor seals respond to human disturbance and noise in a variety of ways. At times, this species cannot be made to disperse from an occupied area even when

severe forms of disturbance are employed, while at other times human disturbance has caused entire haul-outs to be abandoned, causing pups to be separated from their mothers. Low-flying aircraft has been responsible for mass stampedes exiting haul-outs and pupping beaches (Johnson 1977; Pitcher and Calkins 1979). Johnson (1977) estimated that low-flying aircraft may have been responsible for more than 10 percent mortality of the 2,000 pups born on Tugidak Island, Alaska in 1976. Once separated, a pup is likely to die if not reunited with its mother. Pup survival may be reduced if the pup is relocated. Because construction activities are short-term and localized, and since no harbor seal haulout areas have been identified in the immediate project vicinity, construction impacts on harbor seals are expected to be short-term and minor.

Sea Otter. Noise and disturbance from construction activities and increased vessel and aircraft traffic associated with construction activities could cause sea otters to abandon or avoid otherwise suitable habitat (USFWS 1993). However, Riedman (1983) subjected sea otters in California to simulated industrial noises associated with oil and gas exploration and development and found no movements of otters out of the vicinity of the sound projection, indicating no habitat abandonment. One group of otters displayed slightly alarmed behavior at the close approach of a seismic air gun vessel and the loud airborne sounds generated. Mating activities and mother-pup interactions were considered unaffected during all phases of the air gun experiments. Riedman (1983) concluded that the behavior, density, and distribution of sea otters in the study area was not affected by the playback of industrial noises and the sounds generated by the air guns. Sea otters appear to habituate to regular human activity, as they may be commonly viewed swimming leisurely about the docks of Valdez or from fast-moving commercial glacier/wildlife viewing boats in Prince William Sound and the Gulf of Alaska. Noise associated with construction will most likely have negligible impacts on the Cook Inlet sea otter population.

4.7.2 Impacts During Normal Operations

Potential impacts on marine biological resources during normal operations result primarily from Osprey Platform discharges, including sanitary waste, deck drainage, domestic waste, non-contact cooling water, excess cement slurry, fire control system test water, and boiler blowdown. The discharges are described in Section 2.2.1; impacts on water quality are discussed in Section 4.5.

4.7.2.1 Lower Trophic Level Organisms

Low concentrations of BOD and nutrients in the sanitary waste discharge could stimulate primary productivity and enhance zooplankton production. This effect is anticipated to be negligible.

4.7.2.2 Fish

No adverse impacts on fish are expected due to the waste stream discharges from the Osprey Platform. Total residual chlorine (the only toxic contaminant of concern) will be discharged at concentrations that meet water quality criteria designed to protect both human health and aquatic life. Discharges will be diluted by the strong tidal flux of Cook Inlet. All of the wastewater discharges will comply with water quality standards for the state of Alaska (18 AAC.70). Therefore, impacts on fish from normal operations are not expected to occur. Potential impacts on fish and essential fish habitat are discussed in more detail in the Essential Fish Habitat Assessment prepared for the Osprey Platform (Appendix C).

4.7.2.3 Marine Birds

No adverse impacts on marine birds are expected due to the waste stream discharges from the Osprey Platform. Minor noise impacts generated during production operations could result in negligible to minor impacts on nesting birds in the Redoubt Bay Critical Habitat Area.

4.7.2.4 Marine Mammals

Discharges will be diluted by the strong tidal flux of Cook Inlet. Low concentrations of nutrients in the sanitary waste discharge may stimulate primary productivity and enhance zooplankton production, but these effects will probably be negligible. Total residual chlorine (the only toxic contaminant of concern) will be discharged at concentrations that meet water quality criteria designed to protect both human health and aquatic life. All of the wastewater discharges will comply with water quality standards for the state of Alaska (18 AAC.70). Therefore, impacts on marine mammals from wastewater discharges are not expected to occur.

4.7.3 Accidents

The following sections consider the impacts to marine species of a major oil spill from either a well blowout at the Osprey Platform or an underwater pipeline rupture. A well blowout could release 5,500 barrels per day of crude oil; a pipeline rupture could release 1,633 barrels of crude oil. A spill of this magnitude could potentially occur but is not likely to occur during the life of the project (see Section 4.1.4).

4.7.3.1 Lower Trophic-Level Organisms

An oil spill associated with the proposed project could affect plankton and benthic communities. The effects of hydrocarbons on phytoplankton and zooplankton depend on the concentration and type of contaminant, and vary widely (NRC 1985). Studies have shown hydrocarbons to inhibit phytoplankton growth or cause mortality at higher concentrations (1 to 10 ppm), yet enhance growth at concentrations ≤0.1ppm (NRC 1985). Hydrocarbon concentrations of approximately 0.05 to 10 ppm are lethal to zooplankton (NRC 1985). Sublethal effects on zooplankton include reduced feeding and reproductive activity, and altered metabolic rates. Exposure time, toxicity, species, and life stage are all factors that influence the severity of impacts (MMS 1996a). Plankton communities exposed to oil spills and chronically polluted waters experienced short-lived effects in the field (MMS 1996a).

The effect of oil spills on benthic organisms depends on the type and amount of oil which they are exposed to (MMS 1996a). In most instances, oil spills float and most oil does not sink to the bottom. Therefore, it is unlikely that benthic communities would be heavily oiled from a blowout. Sublethal impacts associated with low concentrations of oil in the water column would be expected in the immediate vicinity of a spill. Sublethal effects to plants include reduced growth and decreased photosynthesis and reproductive activity; sublethal effects to marine invertebrates include injuries to physiological, reproductive, and growth processes (MMS 1996a). The greatest impact would be to immobile benthic organisms.

A spill that spreads to coastal areas by wind and current action could become concentrated in estuarine and coastal habitats and contaminate them. Contamination of these benthic habitats would result in the loss of biological productivity and diversity of oil-sensitive invertebrate communities. The effects could be long term in areas where oil is retained in sediments and persist for years. Thomas (1976) found that bivalve community numbers continued to decline for six years after initial oil exposure. Community

recovery could take up to seven years (MMS 1996a). The negative impacts of oil contamination on benthic invertebrates may indirectly impact higher trophic-level species such as fishes and birds, especially shorebirds that feed on benthic invertebrates.

Depending on the size and location of the oil spill, negative impacts to lower trophic-level organisms could be negligible to moderate, with potential long-term impacts.

4.7.3.2 Fish

Fish mortality associated with the proposed project could be a direct consequence of exposure to a concentrated oil spill. Oil spills can have lethal effects on fishes (Howarth 1991), depending on spill size, oil type, season, weather conditions, and species contacting oil (Rice et al. 1984; MMS 1996a).

Location and timing of an oil spill would determine any adverse effect to Pacific salmon in Cook Inlet. Because of the limited area affected by even large oil spills relative to the pelagic distribution and highly mobile migratory patterns of salmonids, most impacts would be limited to a small fraction of the populations. The weathering and dispersal of the spilled oil would limit the length of time that the area would be affected. Pacific salmon are also able to detect and avoid oil spills in marine waters (Weber 1981; Dames and Moore 1990), which would reduce contact. Salmon aggregates in marine waters consist of mixed stocks, so even in the unlikely event of contact with an oil spill, a small fraction of any unique spawning population would be adversely affected.

Petroleum hydrocarbons can have numerous sublethal effects on fishes, and are known to alter behavior (e.g., feeding, predator avoidance), physiology (e.g., respiration, growth), physical development, pathogen resistance, and organ structure (Rice et al. 1984; Howarth 1991; MMS 1996b). Fish can incur sublethal effects well below the acute lethal dosages (Moles et al. 1981; Urho 1990). Oil exposure is known to slow growth of demersal fishes (flounder; Howarth 1991) and pelagic fishes (salmon fry and alevins; Moles et al. 1981; Wertheimer and Celewycz 1996; Willette 1996). Oil exposure reduces growth when fish shunt energy from growth to hydrocarbon metabolism and excretion (Rice et al. 1984; Willette 1996). Reduced growth can impair fish feeding rate, predator avoidance, and migration to suitable habitat and can therefore make survival in natural environments unlikely (Rice et al. 1984; Howarth 1991).

Additional sublethal effects of oil spills have been documented for salmon. Petroleum hydrocarbons may reduce the homing ability of salmon by damaging olfactory tissues (Babcock 1985). Oil exposure is known to slow growth of salmon fry and alevins (Moles et al. 1981; Wertheimer and Celewycz 1996; Willette 1996). Sublethal consequences to anadromous fish populations from an oil spill associated with the proposed project are moderate and long-term.

Fish that inhabit surface waters are more susceptible to oil exposure (MMS 1996a), but intertidal species can be trapped by oil driven ashore (Rice et al. 1984).

The effects of oil exposure to fish ranges from negligible to high, depending on the size, location, and timing of a spill. Mortalities and sublethal effects to fish populations could directly cause moderate, long-term consequences.

4.7.3.3 Marine Birds

Oil spills present the greatest potential threat to negatively impact marine bird species in Cook Inlet. A large oil spill in an area of high bird concentrations could affect thousands of birds, causing high mortality. Spill effects on marine birds have been well documented (MMS 1996b; Wells et al. 1995). Oil

that contacts feathers directly can cause birds to die from hypothermia or drowning; oil ingested by preening birds may be toxic. Oil may also contaminate waterfowl and shorebird food sources such as benthic invertebrates and plant materials. For nesting birds, eggs may become contaminated from oiled feathers of incubating adults and produce toxic effects on chick embryos. Impacts on bird populations would be moderate to major depending on the timing, location of the oil spill, and number of birds that contact oil.

In addition, oil from a spill may be transported by wind and currents and could affect birds in other areas, either directly impacting them or contaminating food sources over a large area. Shallow nearshore benthic habitats used by diving ducks for feeding could be negatively impacted, as could intertidal feeding habitats used by shorebirds. Large areas of open water used by surface feeding species could also be contaminated. Currents in the lower Cook Inlet could move an oil spill into the Shelikof Strait, which is a high use area for marine birds and waterfowl (Forsell and Gould 1981), and negative impacts could be significant.

The effects of contamination of prey organisms or other food sources can be long-term and result in reduction of reproductive capabilities of predator species (Patten 1993). MMS (1996b) estimated that it would take at least three generations (approximately 15 years) for bird species to fully recover from a 50,000-barrel oil spill. Recovery times for predator species can be lengthy and last for a number of years. The extent of the impacts could be moderate to major depending on a number of factors including size of the oil spill, effects of wind and currents, quality and quantity of affected habitat, and number of birds using the affected area.

An oil spill in Cook Inlet can negatively impact birds at any time of the year (DeGange and Sanger 1986). Seasonal shifts in bird populations are largely the result of migration. Large concentrations of birds occur during spring migration when large numbers of waterfowl and shorebirds pass through the area. Waterfowl and shorebird numbers decline during the summer as these birds continue migrating north. At this time, numbers of breeding gulls, cormorants, and alcids increase as do numbers of seabirds such as fulmars and storm petrels. In the fall, bird densities drop as gulls and sea ducks depart and alcids move to pelagic waters, although dabbling duck and goose densities increase. Winter population densities are lower than other times of the year, as most gulls and migrating waterfowl have departed; sea ducks and seabirds are the most common groups during the winter.

Noise and disturbance associated with intensive oil spill cleanup activities may also contribute to the displacement and reproductive failure of many species of nesting birds.

Potential impacts on nonendangered bird species due to accidental spills in Cook Inlet under the proposed project could be minor to major and long-term, depending on size, location, and timing of a spill.

4.7.3.4 Marine Mammals

Nonendangered Baleen Whales (Minke and Gray Whales). Oil spills could affect minke and gray whales occupying Cook Inlet waters through inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency, and skin and/or sensory-organ damage. Based on observations from the Exxon Valdez oil spill, MMS (1996b) estimated that there would be minimal effect on minke and gray whales from a 50,000-barrel oil spill. An oil spill could have a larger impact during the summer, when whales may be present in Cook Inlet. However, because they are only infrequent visitors to Cook Inlet, and only individual minke and gray whales likely make limited excursions into the upper Cook Inlet, the magnitude of effect on the population as a whole should be negligible.

For both whale species, the number of whales affected by an oil spill would depend on the time of year and duration of the spill, the quantity of the spill, and an individual whale's ability to avoid the spill. The movement of oil into lower Cook Inlet or Shelikof Strait may affect a larger number of individuals. For example, gray whales migrate close to shore in southcentral Alaska and oil spills in Cook Inlet could affect feeding during migration.

Increased noise and disturbance from oil spill response and cleanup activities would have similar impacts as construction, due primarily to increased vessel and aircraft traffic. Potential impacts on minke and gray whales due to oil spills from the Osprey Platform or pipeline are expected to be negligible to minor.

Killer Whale. Accidental oil spills are most dangerous to killer whales through ingestion of contaminated prey (Geraci 1990; Würsig 1990). Bioaccumulation of toxins could lead to fatalities; however, if fatalities occur, they are expected to be few and have a negligible effect at the population level. Killer whale pods actively used oil-contaminated areas the year following the *Exxon Valdez* oil spill (Matkin et al. 1994). Because killer whales do not appear to avoid oiled areas, their risk of contamination is high. In addition, a higher mortality rate was observed in resident killer whales in Prince William Sound following the *Exxon Valdez* oil spill (Matkin et al. 1994). However, the increased mortality could not be directly attributed to the *Exxon Valdez* oil spill. Killer whales inhabit Cook Inlet during the summer; the number of killer whales is unknown. Consequently, any impacts from an oil spill would most likely occur at the individual level. Increased noise and disturbance from oil spill response and cleanup activities would have similar impacts as construction, due primarily to increased vessel and aircraft traffic. Potential impacts on killer whales due to oil spills from the Osprey Platform or a pipeline rupture are expected to be negligible to minor at the population level.

Harbor and Dall's Porpoise. The effects of oil spills on harbor and Dall's porpoises are expected to occur through ingestion of contaminated prey (Geraci 1990; Würsig 1990). Bioaccumulation of toxins could lead to fatalities; however, if fatalities occur, they are expected to be few and have a negligible effect at the population level. In general, both species are wide-ranging and could avoid areas contaminated by oil. However, harbor porpoises inhabit more nearshore areas and thus may be more affected by oil spills than Dall's porpoises. MMS (1996b) estimated that effects of a 50,000-barrel oil spill on harbor and Dall's porpoises would be minimal. An oil spill would most likely displace individuals from the contaminated area for several months. A few individuals may experience moderately adverse effects from contact with oil. Increased noise and disturbance from oil spill response and cleanup activities would have similar impacts as construction, due primarily to increased vessel and aircraft traffic. Potential impacts on harbor porpoise and Dall's porpoise due to oil spills from the Osprey Platform or a rupture in the pipeline are expected to be negligible to minor at the population level of either species.

Harbor Seal. Harbor seals are year-round residents of Cook Inlet. Oil spills could affect harbor seals directly by causing toxic stress and displacement and indirectly by altering forage availability. Cleanup activities may also physically disturb and displace harbor seals. Studies following the *Exxon Valdez* oil spill showed a significant decline in abundance of harbor seals at oiled sites in Prince William Sound soon after the spill, and at least 302 seals were missing at that time (Frost et al. 1994a). Elevated concentrations of hydrocarbons and other oil traces were found in tissue samples and bile of harbor seals found dead or collected from oiled areas in 1989 (Frost et al. 1994b). One year later, they found no elevated levels of hydrocarbons in harbor seal tissue taken from Prince William Sound, but oil traces were still present in bile samples. Likewise, Spraker et al. (1994) collected tissue samples from 27 seals in both oiled and non-oiled areas in 1989. Conjunctivitis, skin irritation, and liver and brain lesions were more common in oiled seals. Spraker et al. (1994) hypothesized that the damage was reversible in most

cases. Nineteen seals found dead in the Sound or at rehabilitation centers also were examined. Thirteen of the 19 seals were pups and probably died due to oil toxicity or stress-related effects, while two adults were killed by blunt trauma, possibly during cleanup activities. Based on MMS (1996b) estimates, a limited number of harbor seals could die as a result of a 50,000-barrel spill in lower Cook Inlet. Increased noise and disturbance from oil spill response and cleanup activities would have similar impacts as construction, due primarily to increased vessel and aircraft traffic. Oil spills from the Osprey Platform or a rupture in the pipeline are expected to have minor to moderate impacts on local populations. Pups are more susceptible to the toxic effects of oil and stress.

Sea Otter. Sea otters rely solely on their fur for insulation (Rotterman and Simon-Jackson, 1988) and regularly groom themselves to maintain proper insulation. For these reasons, the species is highly vulnerable to direct oil contamination. Other long-term effects from an oil spill on sea otter populations include loss or contamination of prey, and physiological changes from ingesting contaminated forage and from direct oiling.

Although helicopter surveys following the *Exxon Valdez* oil spill did not detect significant decreases of sea otter abundance in oiled areas, boat-based surveys indicated a 35 percent decline in oiled areas of Prince William Sound. Garrott et al. (1993) estimated an acute mortality of 2,800 sea otters resulting from the spill. Agler and Kendall (1997) concluded that sea otter populations in the spill areas showed continued effects from the *Exxon Valdez* spill, even though limited baseline data has restricted their ability to determine injury and assess recovery. Doroff and Bodkin (1996) determined that prey composition and foraging success of sea otters did not differ among oiled and non-oiled study sites two years after the spill. Tissues of subtidal bivalve prey did not differ in the amount of hydrocarbons present throughout the study area. However, juveniles were found to feed more frequently in intertidal regions. This would put them at greater risk of chronic exposure to hydrocarbons, as Babcock et al. (1993) found mussel tissues sampled in 1989 to 1992 from intertidal regions of untreated oiled beaches to exhibit hydrocarbon concentrations similar to crude oil. In 1993, hydrocarbon concentrations in sediments and mussels were 50 percent lower than in 1992 (Babcock et al., 1996). From 1996 to 1998, Ballachey et al. (1999) examined CYP1A levels, a biomarker of hydrocarbon exposure, found in blood samples taken from sea otters in the oiled and non-oiled areas of Prince William Sound. Nine years after the spill, sea otters in the oiled areas have elevated CYP1A levels, indicating continued exposure or lingering signs of oil. They concluded that no relation between CYP1A and individual health or condition could be detected, and the effect of chronic oil exposure on future population recovery is not known.

Sea otters are sensitive to the impacts of oil spills and direct mortality of individual sea otters can result. Population level impacts appear to have resulted from the *Exxon Valdez* spill, and depending on the location, future spills could result in major population level effects, depending on the area. Although the number of sea otters inhabiting Cook Inlet is unknown, they are found primarily in lower Cook Inlet. Effects from an oil spill from the Osprey Platform would have moderate impacts to sea otters inhabiting the lower portion of the inlet. Increased noise and disturbance from oil spill response and cleanup activities would have similar impacts as construction, due primarily to increased vessel and aircraft traffic. Overall, oil exposure due to spills associated with the Osprey Platform could result in moderate and long-term impacts to sea otters in Cook Inlet.

4.7.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). During construction, about 20 acres of seafloor (and corresponding benthic habitat) would be disturbed under this alternative. The location of the pipeline would bring construction activities in closer proximity to major concentrations of birds at the Redoubt Bay Critical Habitat Area. If conducted during the nesting season, construction activities could adversely

impact marine birds. The potential impacts of a blowout from the Osprey Platform described above for the proposed project would also apply to Alternative 2. Additional underwater pipeline would be installed for Alternative 2 (3.3. miles, compared to 1.8 miles for the proposed project); the increased pipeline length will increase the likelihood of a pipeline rupture. The impacts of a major oil spill on marine biological resources (lower trophic-level, fish, marine bird and mammal populations) would be comparable for the proposed project and Alternative 2.

Alternative 3 (Offshore Pipeline to Trading Bay). During construction, about 63 acres of seafloor (and corresponding benthic habitat) would be disturbed under this alternative. The potential impacts of a blowout from the Osprey Platform described above for the proposed project would also apply to Alternative 3. Additional pipeline would be installed (10.5 miles, compared to 1.8 miles for the proposed project), which will increase the likelihood of a pipeline rupture. The impacts of a major oil spill on marine biological resources (lower trophic-level, fish, marine bird and mammal populations) would be comparable for the proposed project and Alternative 3.

Alternative 4 (No Action). Alternative 4 is a no action scenario that involves no construction or production operations and therefore would have no environmental consequences on marine biological resources.

4.7.5 Cumulative Impacts

Construction impacts are short-term and localized, and are not expected to contribute to cumulative impacts on marine biota.

As discussed in Section 4.5 (Marine Water Quality), wastewater discharges from the Osprey Platform are minimal, and their contributions to the cumulative loading of contaminants in Cook Inlet are anticipated to be negligible. Thus, there would be no cumulative impacts to marine biological resources from the discharges associated with the Osprey Platform.

The likelihood of oil and other contaminant spills increases with increased industrial activity in Cook Inlet. Damage caused by oil contamination would depend on the size and duration of the spill, time of year, and biota density. Multiple spills would further contribute to cumulative effects. Cumulative effects on the described marine resources in Cook Inlet due to oil spill accidents would range from negligible to moderate, depending on the scope of the spills.

4.7.6 Mitigation Measures

The following applicable mitigation measures have been identified to minimize environmental impacts on marine biological resources:

- Timing of construction activities to avoid bird nesting periods, migrating waterfowl and shorebirds, and nearshore migrating fish.
- Monitoring of water quality to ensure compliance with water quality criteria.
- Installation of overfill protection and secondary containment on tanks.
- Use of blowout preventers and monitoring of drilling weight to minimize the potential for a well blowout.
- Installation of a SCADA monitoring and control system.

- Internal and external monitoring of pipelines.
- Use of periodic side scan sonar surveys (at least every 2 years) to inspect the integrity of the pipelines and conduct remedial actions if potential problems are observed.
- Preparation and adherence to an ADEC-approved Oil Discharge Prevention and Contingency Plan (C-Plan).
- Preparation and adherence to Facility Response Plans as required by the Oil Pollution Act of 1990.
- Preparation of a Spill Prevention Control and Countermeasures (SPCC) Plan as required by EPA.
- Maintain membership in CISPRI, a federally-approved Oil Spill Removal Organization.

4.8 THREATENED AND ENDANGERED SPECIES

Threatened and endangered species that could occur near the project site include: Steller's eider, short-tailed albatross, fin whale, humpback whale, blue whale, northern right whale, and Steller sea lion. In addition, beluga whales have been identified as depleted under the Marine Mammal Protection Act and are included in this section as a cetacean of special concern.

Potential environmental impacts to endangered and threatened species may result from noise and other disturbances during construction, wastewater discharges during normal operations, and effects of accidental oil spills. Sections 4.8.1 through 4.8.3 describe potential impacts associated with the proposed project; potential impacts of Alternatives 2, 3, and 4 are discussed in Section 4.8.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.8.5 and 4.8.6, respectively.

4.8.1 Impacts During Construction

Construction impacts associated with the proposed project are not likely to impact threatened and endangered species because of their infrequent occurrence near the project site. Beluga whales, however, could be impacted by noise and vessel traffic associated with construction activities. Belugas display a variety of behavioral responses, ranging from tolerance to extreme sensitivity, to noise and vessel traffic which may occur during construction activities. Reactions depend greatly on the whale's behavior, habitat, boat type, and boat activity. In areas where belugas are hunted by boat, such as Cook Inlet, small vessel traffic has been known to alter local distribution (Seaman and Burns 1981; Burns and Seaman 1986; Caron and Smith 1990). Beluga reactions to vessels traveling at slow to moderate speed on steady courses are less than those to vessels moving faster or erratically (Blane 1990; Blane and Jaakson 1994). Conversely, larger vessels traveling in a consistent direction are tolerated greatly by belugas (Fraker 1977; Macfarlane 1981; Sergeant 1981, 1986; Burns and Seaman 1986; Pippard 1985).

Additional stress on the Cook Inlet stock of beluga whales caused by construction may reduce fitness and survivorship. Since the population is at a low level and in decline, any disturbances which could reduce fitness of Cook Inlet belugas could potentially impact the population, depending on the number of whales affected. However, construction activities are anticipated to be short-term and localized and are therefore unlikely to significantly impact belugas

4.8.2 Impacts During Normal Operations

Potential impacts on threatened and endangered species during normal operations could result primarily from Osprey Platform discharges, including sanitary waste, deck drainage, domestic waste, non-contact

cooling water, excess cement slurry, fire control system test water, and boiler blowdown. The discharges are described in Section 2.2.1; impact on water quality are discussed in Section 4.5. Potential impacts of wastewater discharges on threatened and endangered species were evaluated as part of a Biological Assessment (BA) prepared for the Osprey Platform in compliance with Section 7 of the ESA. The BA is provided as Appendix B to this EA; conclusions of the BA are summarized below.

4.8.2.1 Steller's Eider

Steller's eiders are only occasional winter visitors to the western side of Cook Inlet. Wastewater discharges associated with the Osprey Platform are not likely to directly or indirectly affect Steller's eiders, nor is the action likely to adversely affect or jeopardize the threatened Alaska nesting populations or its critical habitat. The actions are also not likely to have incremental effects resulting in a cumulative impact to Steller's eiders or their proposed critical habitat.

4.8.2.2 Short-tailed Albatross

The Short-tailed albatross has not been observed in the coastal waters of Cook Inlet since prior to 1947. Therefore, wastewater discharges associated with the Osprey Platform will not likely have any direct, indirect, or cumulative impacts on the Short-tailed albatross. Neither will it jeopardize the recovery of this species.

4.8.2.3 Fin, Humpback, Blue, and Northern Right Whales

Humpback and fin whales are not be found regularly above Kachemak Bay; blue and northern right whales would be only accidental visitors to lower Cook Inlet. Discharges from the Osprey Platform are not likely to directly or indirectly impact any of the four endangered whale species, nor is the action likely to adversely affect or jeopardize the endangered Alaska populations or their critical habitat. The proposed project also will not have incremental effects resulting in a cumulative effect to these species.

4.8.2.4 Steller Sea Lion

A small number of Steller sea lions may occur near the project area. Discharges from the Osprey Platform will be diluted by the strong tidal flux of Cook Inlet, however, and any disturbance of Stellar sea lions would be very short-term and unlikely to adversely affect the animals.. Wastewater discharges associated with the Osprey Platform are not likely to directly or indirectly affect Steller sea lions, nor is the action likely to adversely affect or jeopardize the threatened Alaska population or its critical habitat. The actions are also not likely to have incremental effects resulting in a cumulative impact to Steller sea lions or their proposed critical habitat.

4.8.2.5 Cetacean of special concern -- Beluga whale

Wastewater discharges from the Osprey Platform will occur outside areas in Cook Inlet where large concentrations of belugas are present during the summer (NMFS 2000d). Although the platform will be operated year-round, the West Foreland is not heavily used by beluga whales (Smith and Mahoney 1999). The volume and concentration of pollutants in the discharges from the platform are minimal; once released, the discharges will be rapidly dispersed by the strong tidal fluxes in Cook Inlet. Therefore, it is unlikely that wastewater discharges would directly or indirectly affect Cook Inlet belugas or their critical habitat. The proposed actions are also not likely to have incremental effects resulting in a cumulative impact to this species.

4.8.3 Accidents

The following sections consider the impact on threatened and endangered species of a major oil spill from a well blowout at the Osprey Platform or an underwater pipeline rupture. A well blowout could release 5,500 barrels per day of crude oil; a pipeline rupture could release 1,633 barrels of crude oil. A spill of this magnitude could potentially occur, but is not likely to occur during the life of the project (see Section 4.1.4).

4.8.3.1 Steller's Eider

Although Steller's eiders have not been reported in the project area they do winter in shallow, nearshore marine habitats of lower Cook Inlet (both the eastern and western sides of the Inlet) where they feed on benthic invertebrates and amphipods. Habitat use in upper Cook Inlet is currently unclear. Molting and wintering birds could be affected by oil spills either by direct contact with oil, ingestion of oil from preening oil-soaked feathers, or from contaminated food sources. MMS (1996b) estimated that less than 2 percent of the winter population of Steller's eiders could be impacted from a spill in lower Cook Inlet. The impact may be considerably less for a spill that occurs in the upper Cook Inlet; the level of impact will depend on the timing, size, and location of the spill. Since a major oil spill (such as a well blowout or pipeline rupture) is unlikely, the proposed project may affect but is not likely to adversely affect Steller's eiders.

4.8.3.2 Short-tailed Albatross

Annual observations of the short-tailed albatross, a pelagic seabird, have been recorded in the Gulf of Alaska and the North Pacific since 1947. The short-tailed albatross has not been observed in the coastal waters of Cook Inlet since observations began (1947 through 1999) (AKNHP 2000; IPHC 1999). Therefore, impacts on the short-tailed albatross from an oil spill associated with the Osprey Platform will be negligible.

4.8.3.3 Fin, Humpback, Blue, and Northern Right Whales

Oil spills could cause the following temporary, nonlethal effects in fin, humpback, blue, and northern right whales: inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling that would reduce feeding efficiency, and skin and/or sensory-organ damage. Because individual whales, especially, fin and humpbacks, may only be present in lower Cook Inlet during the summer, but are rarely present in the upper Cook Inlet, it is improbable that many whales would be affected by an oil spill. Consequently, effects on endangered whales from exposure to an oil spill are expected to be minimal.

4.8.3.4 Steller Sea Lion

Although not present in the project area, Steller sea lions inhabit some areas in the lower Cook Inlet and individual sea lions may occur regularly in the upper inlet. In Cook Inlet, the only possible impact to Steller seal lions would be a major oil spill. Oil would affect sea lions if it directly contacted individuals, rookeries, haul-outs, or major prey species. In addition, vessel and human activity associated with cleanup efforts may cause sea lions to abandon coastal haul-out areas and/or rookeries for an extended period of time.

Oil spills would have the most severe impact on Steller sea lions during late spring, summer, and early fall, when they are concentrated at rookeries. At these times, any spill and/or cleanup operation has the potential to disturb hundreds of sea lions. If a rookery was contaminated with oil, the current rate of

population decline could accelerate significantly (Calkins et al. 1994). Overall, with the current population declines in Alaskan waters, any oil spill could potentially impact the population, depending on the size, location and timing of the spill, as well as the number of spills per season.

Direct contact with oil would affect sensitive tissue areas of adult sea lions, causing irritation to eyes, nasal passages, and lungs. Contamination of pups could have more long-term effects. A decline in prey species due to oil contamination could increase sea lion mortality. This effect would probably be more long-term on the population as a whole than would direct contact with a spill itself.

For a spill in lower Cook Inlet, MMS (1996b) estimated less than 100 sea lion deaths, where recovery would take approximately one generation. For a major spill in upper Cook Inlet, the impact would be even lower.

Cleanup operations, including helicopter overflights and vessel traffic, could also potentially increase pup mortality if operations occurred near rookeries. Steller sea lions are very easily disturbed while in their rookeries, and adults may stampede into the water, trampling pups. Any increased mortality in the sea lion population could impact the population as a whole, given the current severe state of decline.

Steller sea lions can be found in the general region where the Osprey Platform will operate. However, no rookeries or haul-outs are located in the project area (the nearest rookery and haul-out are located on the Barren Islands) and impacts would likely be expressed on an individual level. Therefore, while potential impacts on individual Steller sea lions could occur due to an oil spill associated with the proposed project, the project is not likely to adversely affect Steller sea lion populations or critical habitat. Specific impacts would depend on the time of year, size of the spill, and its potential movement.

4.8.3.5 Cetacean of Special Concern -- Beluga Whale

The beluga whale is the only year-round resident marine mammal in upper Cook Inlet. All other marine mammals observed in Cook Inlet are seasonal or accidental migrants into the upper inlet. Contact with oil could cause inhalation of hydrocarbon vapors, reduced prey availability, ingestion of spilled oil or oil-contaminated prey, and skin and/or sensory-organ damage. Cook Inlet belugas may be particularly sensitive to environmental stress. Oil spills could be fatal to individuals through direct contact or reduction in prey. Displacement caused by oil spills and cleanups could prevent access to important habitat areas where they feed. Any reduction in survivorship could be detrimental to the population. Therefore, a major oil spill associated with the proposed project could adversely affect the beluga population in Cook Inlet, depending on the size and timing of the spill. A major oil spill (such as a well blowout or pipeline rupture) is not expected to occur during the life of the project (see Section 4.1.4); mitigation measures described below will reduce the probability of a major spill and its consequences. Small oil spills could result in minor to moderate impacts on the Cook Inlet beluga population.

4.8.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). The potential impacts of a major oil spill as described above for the proposed project would also apply to Alternative 2. Additional underwater pipeline will be installed for Alternative 2 (3.3 miles, compared to 1.8 miles for the proposed project), thereby increasing the likelihood of a pipeline rupture. The impacts of a major oil spill on threatened and endangered species would be comparable for the proposed project and Alternative 2.

Alternative 3 (Offshore Pipeline to Trading Bay). The potential impacts of a major oil spill as described above for the proposed project would also apply to Alternative 3. Additional underwater pipeline will be

installed for Alternative 3 (10.5 miles, compared to 1.8 miles for the proposed project), thereby increasing the likelihood of a pipeline rupture. The impacts of a major oil spill on threatened and endangered species would be comparable for the proposed project and Alternative 2.

Alternative 4 (No Action). Alternative 4 is a no action alternative that involves no construction or production operations and therefore would have no environmental consequences on threatened and endangered species.

4.8.5 Cumulative Impacts

Construction impacts are short-term and localized, and are not expected to contribute to cumulative impacts on threatened and endangered species. As discussed in Section 4.5., wastewater discharges from the Osprey Platform are minimal, and their contribution to the cumulative loading of contaminants in Cook Inlet are anticipated to be negligible. No cumulative impacts on threatened and endangered species are expected to occur as a result of wastewater discharges during normal operations.

The likelihood of oil and other contaminant spills increases with increased industrial activity in Cook Inlet. Damage caused by oil contamination would depend on the size and duration of the spill, time of year, and biota density. Multiple spills would further contribute to cumulative effects. Cumulative effects on threatened and endangered species would range from negligible to moderate, depending on the scope and timing of the spills. In particular, the beluga whale population in Cook Inlet is at a low level and in decline. Additional stress on the Cook Inlet stock of beluga whales may reduce fitness and survivorship; any disturbances which reduce the fitness of Cook Inlet belugas could potentially impact the population.

4.8.6 Mitigation Measures

Applicable mitigation measures have been identified to minimize environmental impacts to threatened and endangered species, including actions that would reduce the probability of oil spills and the environmental consequences if a spill did occur. Applicable mitigation measures include:

- Timing of construction activities to avoid seasonal concentrations of beluga whales.
- Monitoring of water quality to ensure compliance with water quality criteria.
- Installation of overfill protection and secondary containment on tanks.
- Use of blowout preventers and monitoring of drilling weight to minimize the potential for a well blowout.
- Installation of a SCADA monitoring and control system.
- Internal and external monitoring of pipelines.
- Use of periodic side scan sonar surveys (at least every 2 years) to inspect the integrity of the pipelines and conduct remedial actions if potential problems are observed.
- Preparation and adherence to an ADEC-approved Oil Discharge Prevention and Contingency Plan (C-Plan).
- Preparation and adherence to Facility Response Plans as required by the Oil Pollution Act of 1990.
- Preparation of a Spill Prevention Control and Countermeasures (SPCC) Plan as required by EPA.

- Maintain membership in CISPRI, a federally-approved Oil Spill Removal Organization.

4.9 TERRESTRIAL BIOLOGICAL RESOURCES

Potential impacts on terrestrial biological resources may result from construction activities, vehicle and aircraft traffic along roads and onshore pipelines, habitat loss and alteration, and oil spills from the Kustatan Production Facility or pipelines. Potential environmental impacts on terrestrial biological resources associated with the proposed project are described in Sections 4.9.1 through 4.9.3. Potential impacts of Alternatives 2, 3, and 4 are described in Section 4.9.4. Cumulative impacts and applicable mitigation measures are identified in Sections 4.9.5 and 4.9.6, respectively.

4.9.1 Impacts During Construction

4.9.1.1 Vegetation and Wetlands

The proposed project involves the construction of a 1.8-mile access road and pipelines through undisturbed areas from the bluff at the West Foreland to the proposed Kustatan Production Facility near Kustatan. A wetland survey of the road/pipeline alignment and proposed onshore production facility was conducted by Harding Lawson Associates for Forest Oil In September 2000 (HLA 2000). The survey indicated that the proposed alignments will cross small segments of four wetlands areas (Figure 3-4); these areas will require a Corps of Engineers Wetlands Permit. Wetlands mitigation and restoration requirements posed by the Corps of Engineers as part of the permitting process will need to be implemented.

Forest Oil has estimated that the proposed project would involve potential impacts to 29 acres of undisturbed area for pipeline placement and construction of the access road (NCG 2001). If the borehole method of pipeline placement at the bluff is determined to be technically feasible (see Section 4.2.1.1), disturbance will be reduced by about 3 acres. This represents less than 0.2 percent of the West Forelands area.

Four wetlands areas, totaling approximately 772 lineal feet of wetland are crossed by the proposed trail route (HLA 2000). Footage for each wetland crossed is as follows:

- FOR1: two crossings at 65 feet and 125 feet
- FOR2: 177 feet
- FOR3: 363 feet
- FOR7: 42 feet

Assuming a 25-foot wide road, plus potential disturbance to 50 feet on either side of the road, about 2.2 acres of wetland could potentially be impacted. Rerouting the access road as discussed in Section 4.9.1.6 below would reduce the area of wetlands potentially impacted by the proposed project. Approximately 363 feet of crossing (FOR3 on Figure 3-4) can be avoided by rerouting the access road slightly to the north.

Because of the relatively small area of wetlands that will be impacted by the construction of the proposed project, the construction impacts of the proposed project on onshore wetlands and vegetation is expected to be minor.

4.9.1.2 Birds

Terrestrial birds may be impacted by noise from construction activities if onshore clearing is conducted after nesting begins. Most clearing activities are normally either conducted within several weeks of winter breakup (prior to birds nesting) or after birds have left the nest by mid summer. The access route to the tip of the West Foreland was cleared in the winter of 2000 to provide tracked vehicle access to the area to conduct soils borings. The timing of these actions would have avoided bird nesting periods. Similarly, if construction activities for roads and pipelines are conducted outside of critical nesting periods such as nesting for trumpeter swans and Tule white-fronted geese in the Redoubt Bay area, potential impacts will be minimal.

On a rare occasion, a peregrine falcon may be disturbed by aircraft traffic to the drill rig; avoidance responses are anticipated to have only short-term effects (a few minutes to tens of minutes). Exposure to disturbance, however, is expected to be infrequent with minimal effects to the population due to the limited number of flights and the transient behavior of overwintering peregrines (MMS 1995).

4.9.1.3 Terrestrial Mammals

The construction of access roads, onshore pipelaying operations, and construction of the Kustatan Production Facility may result in minor habitat loss and alteration. The area of disturbance is not within a known or designated critical habitat area for terrestrial wildlife, and affects only a small percentage of the undeveloped land in the West Foreland area. Construction activities may result in short-term impacts to seasonal use patterns of brown and black bears. Human-bear interactions could result in the loss of individual bears. Construction activities may also result in short-term and localized impacts on terrestrial mammals from noise. Overall, construction impacts on terrestrial mammals are expected to be minor.

4.9.2 Impacts During Normal Operations

Fugitive dust and emissions from vehicles traveling along the access road could result in adverse impacts on surrounding wetlands areas and vegetation. However, because the road is intended for maintenance, and access to trespassers is limited by the inaccessibility of the area, the frequency of vehicles on the access road should be low. Potential impacts to wetlands and vegetation from normal operations is anticipated to be negligible.

The possible increase in aircraft and supply-boat traffic to and from the Osprey Platform may potentially disturb birds and terrestrial mammals along the traffic routes when occurring near shore. The impacts from increased traffic, however, are expected to have only short-term effects (a few minutes to less than an hour). Displacement of terrestrial mammals is expected to last less than one hour. It is anticipated that operational noises resulting from the proposed Kustatan Production Facility would be mimimal. Offshore platform operations are not expected to affect terrestrial wildlife.

4.9.3 Accidents

4.9.3.1 Vegetation and Wetlands

Onshore oil spills that impact upland or wetlands habitat could potentially occur. An oil tank rupture at the onshore production facility could result in the release of 25,000 barrels (about one million gallons) of crude oil; a produced water tank rupture could cause the release of 5,000 barrels of produced water. An onshore pipeline leak/rupture could result in the release of up to 1,633 barrels (70,000 gallons) of crude oil. Spills could result in damage to wetlands areas, including terrestrial flora and fauna. Although

potential impacts to wetlands areas are likely to be short-term, impacts on these areas would be significant if a major oil spill were to occur. Small spills are likely to occur during the 20-year estimated project life, and would be expected to have a moderate impact on vegetation and wetlands. Small spills would likely be "contained" in small ponds or pools, rather than drain into Cook Inlet. With construction of the access road, spill response equipment can be readily mobilized and access to the potentially affected area is increased. Mitigation measures outlined in Section 4.9.6 could reduce the probability and magnitude of an onshore oil spill.

4.9.3.2 Birds

The effects of spills on birds is well documented (MMS 1996b, Wells et al. 1995). Direct oil contact alone is usually fatal and often results in substantial mortality of many birds. Oiling of birds causes death from hypothermia, shock, or drowning. Oil ingestion through preening of oiled feathers significantly reduces reproduction in some birds and causes various pathological conditions, significant weight loss, and reduced growth in young birds. Oil contamination of eggs by oil-covered feathers of parents also significantly reduces egg hatching through toxic effects on the chick embryo or by abandonment of the eggs, chicks and nest by parent birds. These effects would be primarily associated with waterfowl and shorebird populations, but could also extend to eagles and other predator species (such as eagles) that often use intertidal areas. The most sensitive timing would be during the summer when waterfowl and shorebirds are abundant in the area.

Bird populations could take up to three generations (less than 15 years) to recover from a major oil spill (MMS 1995). Habitat contamination may persist for several years after the spill, and impacts on bird reproduction would be expected to persist for more than one year. The extent of the impacts could be moderate to major depending on a number of factors including size of the oil spill, quality and quantity of affected habitat, and number of birds using the affected area.

Migrating or overwintering peregrine falcons could occur seasonally in the proposed sale area, however such occurrence is anticipated to be uncommon (less than 3 percent of the Alaskan population). Oiling, ingestion of oil, or indirect effects from reduction in prey may impact peregrine falcons in the vicinity of an oil spill. However, due to the infrequent occurrence of peregrines in the area, their foraging habits, and low probability of contact where peregrines might occur, the effect to the peregrine falcon is expected to be minimal (MMS 1995).

4.9.3.3 Terrestrial Mammals

The primary impacts associated with a potential oil spill on terrestrial mammals result from the oil contamination of individual mammals, degradation of coastal habitats, and contamination/reduction of food sources (vegetation, prey, and carrion). The following discussion describes impacts to mammals most likely to be affected by a major oil spill.

Brown and Black Bears. Coastal streams, beaches, mudflats, and river mouths are important bear habitat during the summer and fall months. An oil spill in such habitats would likely result in the ingestion of oil-contaminated food sources such as clams, mussels, and carrion by some brown bears resulting in the mortality of a few to several bears. In addition the ingestion of considerable quantities of oil through grooming of oiled fur may also result in death (Oritsland et al., 1981).

Ingestion of oiled prey from contaminated intertidal habitat could persist for a number of years after the spill. This exposure to oil may result in sublethal effects on the fitness of some bears and a decline in

survival of those bears exposed. Recovery of bears and associated habitat could take several years. However, regional populations are not likely to be impacted.

Coastal River Otters. Coastal beaches, tidal flats, and nearshore marine waters are utilized by river otters for feeding and movements. Due to the considerable amount of time spent feeding in coastal marine waters and foraging along the shoreline, river otters are considered to be at particular risk to direct oiling. Oil contamination of otter habitat could result in the contamination of food sources, direct oiling, and oil ingestion and inhalation of oil-vapor through grooming and consumption of oiled prey. In addition, river otters may also be affected by tissue damage and hemolytic anemia, significant reduction in body mass, reduced diet diversity, avoidance of preferred habitats, loss of thermal insulation, and increases home ranges resulting from exposure to oil (Faro, Bowyer, and Testa, 1991; Tarasoff, 1974). Total recovery of river otters and associated habitat could take as long as three years. Regional populations are not likely to be impacted.

A series of smaller spills may have an additive effect on local wildlife, perhaps increasing losses and habitat contamination.

4.9.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). For Alternative 2, the affected area would be the location of the proposed Kustatan Production Facility as well as the area where the underwater pipeline is brought onshore and enters the production facility. Therefore, the 1.8 mile access road would not be constructed across undisturbed area. A total of 14 acres of land would be disturbed under this alternative (NCG 2001). Impacts on wetlands from construction of Alternative 2 are judged to be negligible to minor. Because Alternative 2 does not involve construction of the 1.8-mile pipeline from the West Foreland to the Kustatan Production Facility, spills and tank ruptures from the Kustatan Production Facility itself are the primary source of potential terrestrial impacts. Potential impacts are expected to be moderate to major if a large oil spill were to occur. Mitigation measures outlined in Section 4.9.6 would reduce the probability and magnitude of an onshore oil spill.

Alternative 3 (Offshore Pipeline to Trading Bay). Alternative 3 does not involve construction of the Kustatan Production Facility, thus would not require a pipeline or access road. It would, however, include a 0.1-mile length of onshore pipeline to the Trading Bay Production Facility. Less than 1 acre of total area would be disturbed (NCG 2001). Impacts on wetlands from construction of Alternative 3 are expected to be minor. A pipeline rupture along the 0.1-mile onshore pipeline could result in the release of 1,075 barrels (45,000 gallons) of crude oil (NCG 2001). Potential impacts are believed to be moderate if the mitigation measures identified in Section 4.9.6 are implemented.

Alternative 4 (No Action). Alternative 4 is the no action alternative and would not result in additional disturbances to any onshore terrain, including wetlands, or to terrestrial birds or mammals.

4.9.5 Cumulative Impacts

Other access roads are present in the immediate area of the proposed project. A 3.5-mile access road was recently constructed from the proposed Kustatan Production Facility (site of the Tomcat Exploratory Well) to West Forelands #1. This road involves disturbance of 12 to 16 acres of previously disturbed areas. This road and other roads from West Forelands #1 to the West McArthur River Unit and Trading Bay Production Facilities to the north were designed to avoid wetlands areas to the extent possible. Cumulative impacts from the addition of the proposed production facility and onshore road/pipeline are considered to be minor.

The cumulative effects of ongoing and future development could result in potential habitat alteration, environmental degradation from a series of smaller spills, and direct mortality effects on these and other terrestrial mammals that reside in the Cook Inlet region. Contribution of the proposed project to cumulative impacts on terrestrial biological resources is expected to be minor.

4.9.6 Mitigation Measures

The following applicable mitigation measures were identified to avoid terrestrial impacts, minimize the potential for an oil spill, and reduce the impacts of an oil spill if one were to occur.

- Eliminate impacts to approximately 363 feet of wetland crossing by rerouting the access road slightly to the north.
- Conduct wetlands mitigation and restoration activities as specified by a Corps of Engineers Wetlands Permit.
- Avoid clearing and other noise-producing construction activities during periods when major concentrations of nesting birds may be in the area.
- Install overfill protection and secondary containment on tanks.
- Install and maintain a SCADA monitoring and control system.
- Perform internal and external monitoring of pipelines.
- Prepare and adhere to an ADEC-approved Oil Discharge Prevention and Contingency Plan (C-Plan).
- Prepare and adhere to Facility Response Plans as required by the Oil Pollution Act of 1990.
- Prepare a Spill Prevention Control and Countermeasures (SPCC) Plan as required by EPA.
- Maintain membership in CISPRI, a federally-approved Oil Spill Removal Organization.

4.10 SOCIOECONOMIC IMPACTS

Potential impacts on the local economy include increased revenues from oil activities, increases in employment and population, and gains/losses from oil spills and cleanup events, including commercial fishing and subsistence harvests at the community level. The proposed project could result in both positive and negative impacts. Positive impacts could result both to the local oil and gas service industry and to the local economy in general. Possible negative impacts could result to the commercial fishing industry and possibly to the tourism industry in the event of a major oil spill. These are discussed below.

4.10.1 Impacts During Construction

Construction activities are anticipated to occur during the second half of 2001; the project is scheduled to begin operations during the first quarter of 2002 (NCG 2001). The estimated cost to construct and install pipelines, roads, and a production facility to treat the oil, gas and water from the Osprey Platform is approximately 75 million dollars (Amundsen 2000b). Roughly 80 to 90 percent of these dollars will pass through the local economy of upper Cook Inlet. Temporary employment during the peak of construction is estimated at 60. Although local residents would not fill all of these jobs, it is assumed that some direct local employment (at least 20 to 30 temporary positions) will occur. Permanent employment opportunities would likely be less than 10 additional persons, because it is expected that personnel

involved in the existing production operations at the West McArthur River Unit can handle many of the new duties.

During construction activities, there may be conflicts in the availability of local resources including lodging, restaurants, etc. between local residents, tourists, sports fishermen, and other recreational users. However, increased demands for these services will provide added local income (and taxes) for the area.

Most of the direct local economic impacts will be short-term and disappear when construction activities have been completed. Overall, these impacts (both positive and negative) are considered to be minor for the proposed project.

Socioeconomic impacts on the commercial fishing industry could occur during construction; these potential impacts are associated with potential use conflicts during pipeline construction activities, especially near the shore approach for the pipeline. Construction impacts would likely be limited to the tip of the West Foreland where the underwater pipeline comes ashore. Although there are no registered set net fishery sites at this location (NCG 2001), there is at least one set net operation known to be located in the immediate vicinity of the shore approach for the pipeline that could potentially be disturbed. To the extent possible, construction activities in these areas will be planned to occur during periods when these seasonal fisheries are not active (NCG 2001). With proper coordination, these impacts are estimated to be minor for the proposed project.

4.10.2 Impacts During Normal Operations

Socioeconomic impacts during normal operations would primarily be positive ones associated with oil and gas production. Increased oil and gas activities in the past several years have enhanced local employment opportunities to some extent; however, there is still additional local capacity for new projects. Any additional or new oil and gas development is certain to have a positive direct and indirect impact on the local oil and gas service industries in the area. An estimated production of 25,000 bbl/day from the Redoubt Shoal Unit Development Project would result in an approximate 90 percent increase in current oil production from the Cook Inlet area.

Direct benefits would include local employment and increased requirements for local service contractors. Direct benefits would also result to the local and state government in the form of tax and royalty revenues. During the production drilling phase (about three years), approximately 36 million dollars per year will pass through the local economy (Amundsen 2000b). This will provide 55 full-time jobs in support of the drilling activity. Ongoing periodic drilling and workover activities will continue to occur over the useful life of the facility. During the production phase (about 20 years), the State of Alaska will receive 7.5 million dollars per year in royalties. The project will generate about 2 million dollars per year in property taxes. The severance taxes will amount to 1.5 million dollars. Operations and maintenance spending is estimated at 2 million dollars per year. The project will support 10 full-time employees (Amundsen 2000b).

Indirect benefits are also likely for downstream users of the oil (and possibly gas) including the Cook Inlet Pipe Line Company (who will haul the oil) and Tesoro Alaska Petroleum Company (who will likely refine the oil). Other potential benefits include the sharing of the Cook Inlet infrastructure, which will reduce the costs to the existing facilities in Cook Inlet.

4.10.3 Accidents

Potential socioeconomic impacts resulting from accidents include negative impacts on the commercial fishing industry in the area. It is expected that the salmon fisheries in the central and upper inlet (areas above Anchor Point) would be the primary industry sector affected by a major oil spill in the upper inlet. The primary impacts to commercial fishing operations from a major spill would include fishing closures, real and perceived fish tainting, and oiling of gear; all could have direct economic impacts.

During the ten year period between 1987 to 1996, the commercial fishing industry in the central and upper inlet averaged about 50 to 60 million dollars in income (Ruesch and Fox 1997); only 2 to 3 percent of this amount occurred in the upper inlet (above the Forelands). Falling salmon prices have resulted in lower prices in the more recent years (average of about 30 million dollars during the period of 1993 to 1996; NCG 2001).

Possible economic losses to the commercial fishing industry from a major spill could to some extent be mitigated by employment of personnel in spill response activities and through direct compensation (through either negotiated or legal settlements with the industry participants). As exhibited by actions following the two larger spills in the general area (*Glacier Bay* and *Exxon Valdez* oil spills), both would likely occur. Potential impacts to the commercial fishing industry could be major but short-term in the event of a spill.

4.10.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Socioeconomic impacts associated with this alternative would be the same as for the proposed project (Alternative 1).

Alternative 3 (Offshore Pipeline to Trading Bay). Socioeconomic impacts associated with this alternative would be the same as for the proposed project (Alternative 1). Potential impacts on commercial fisheries might vary somewhat, given the increased oil spill potential along the longer underwater pipeline (10.5 miles) under this alternative. No information was readily available about set net or other commercial fishing operations in the Trading Bay area near the pipeline shore approach during the preparation of this EA.

Alternative 4 (No Action). Under this alternative, no socioeconomic impacts (positive or negative) would result.

4.10.5 Cumulative Impacts

Within the context of existing regional conditions, the addition of one offshore platform and 7 miles of pipeline (3 pipelines, 1.8 miles each) will not add significantly to potential cumulative effects from oil and gas operations in Cook Inlet. Activities may slightly offset effects of reduced oil production in the region by providing direct and indirect employment and economic benefits to the local communities.

4.10.6 Mitigation Measures

To minimize disturbance to set net fishing operations in the vicinity of the West Foreland, construction activities should be scheduled during periods when these seasonal fisheries are not active.

Mitigation measures to minimize the likelihood of a major oil spill and to reduce the environmental impacts of a spill if one were to occur have been listed in previous sections (see Sections 4.4.6 and 4.5.6).

4.11 IMPACTS ON SUBSISTENCE HARVESTING

Subsistence harvesting is the customary and traditional use by rural Alaska residents of wild, renewable resources for direct personal or family consumption or for customary trade. Impacts on subsistence harvesting patterns may occur from oil spills, industrial disturbance (including noise), construction activities, reduced access to resources, and changes in subsistence practices related to oil and gas activities, increased population and industrial employment. These are discussed below.

4.11.1 Impacts During Construction

The primary impact during construction would be associated with interruption of subsistence set net fisheries at the shore approach. Through coordination of construction activities with local residents (i.e., scheduling disruptive activities when the seasonal fishing activities are not occurring), potential conflicts can be avoided and are expected to be minor. Noise associated with construction activities may influence behavior of fish, birds, and mammals associated with subsistence harvesting activities. Construction-related impacts are expected to be short-term and negligible.

4.11.2 Impacts During Normal Operation

Increased population and industrial employment can create limitations to subsistence practices by reducing access to subsistence resources. However, the proposed project will provide only a limited number of jobs locally; development pressures as a result of this project are anticipated to be minimal. Under normal operations, no impacts are expected to occur on any plant or animal species associated with subsistence harvesting activities.

4.11.3 Accidents

Potential effects on subsistence activities would result primarily from a major oil spill in the upper inlet. Because of its proximity, the community of Tyonek would likely be the greatest impacted. Other communities in which subsistence is a major activity (such as Nanwalek and Port Graham in the lower inlet) might also be impacted by a major spill, but to a much lesser extent because of their greater distance from the proposed project area.

Specific impacts to subsistence would include the possible loss of access to key subsistence food items and subsistence habitats. Specific food items potentially at risk include fish (salmon and hooligan), intertidal benthic organisms (clams), marine mammals (beluga whale and harbor seals), and birds (ducks and geese).

If a major spill were to occur, impact could be significant but would be relatively short-term (one to three years). In the absence of a major spill, impacts will be negligible.

4.11.4 Impacts of Alternatives

Alternative 2 (Offshore Pipeline to Kustatan). Impacts on subsistence harvesting associated with Alternative 2 would be the same as for the proposed project. The underwater pipeline is 1.5 miles longer than for the proposed action, and therefore there would be a slightly higher probability of a pipeline spill. The magnitude of impacts on subsistence harvesting would be comparable.

Alternative 3 (Offshore Pipeline to Trading Bay). Impacts on subsistence harvesting associated with Alternative 3 would be the same as for the proposed action. The underwater pipeline would be 8.7 miles

longer than for the proposed action, and therefore there would be a slightly higher probability of a pipeline spill. The magnitude of impacts on subsistence harvesting would be comparable.

Alternative 4 (No Action). Under the no action alternative, no construction or production operations would occur, and therefore there would be no environmental impact to subsistence harvesting.

4.11.5 Cumulative Impacts

Increased population and industrial employment can create limitations to subsistence practices. However, the proposed project will provide only a limited number of jobs locally; development pressures as a result of this project are anticipated to be minimal. Subsistence also tends to occur at locations where there is an abundance of fish and wildlife resources. If the proposed project were to affect the abundance of fish and other biota in Cook Inlet, it could contribute to cumulative impacts on subsistence harvesting. These potential cumulative impacts are expected to be minor.

4.11.6 Mitigation Measures

To a large extent, impacts associated with construction activities can be mitigated by scheduling construction activities to avoid harvesting periods and through close coordination (e.g., meetings) with local residents. Other appropriate mitigation measures include those that minimize the likelihood of a major oil spill and reduce the environmental impacts of a spill if one were to occur. These mitigation measures have been identified in previous sections (see Sections 4.4.6 and 4.5.6).

4.12 Land and Shoreline Use and Management Impacts

4.12.1 Impact of the Proposed Project

The underwater pipeline will cross areas of the central inlet. Pipeline systems currently exist in the general area of the proposed route. The primary industrial use of the central and upper inlet is by the oil and gas industry. There are no known existing uses that would conflict with this use of the seafloor area along the proposed route. The onshore pipeline route would follow existing pipeline right-of-ways, and there are no known use conflicts that would preclude installation of an additional pipeline along these routes.

The project will undergo a coastal zone management consistency review by the Alaska Division of Governmental Coordination to ensure that there are no conflicts with coastal zone management objectives. Overall, potential adverse impacts related to land use and management objectives are expected to be minimal to minor for the proposed project.

4.12.2 Impacts of Alternatives

Impacts of Alternatives 2 (offshore pipeline to Kustatan) and 3 (offshore pipeline to Trading Bay) on land and shoreline use would be the same as for the proposed project.

4.12.3 Cumulative Impacts

The proposed project would add new oil and gas facilities to the existing 15 offshore platforms, over 500 miles of offshore pipeline in the upper Cook Inlet, and associated onshore facilities along the shore of the inlet. Oil and gas exploration and development projects have been conducted in the Cook Inlet since the late 1950s onshore and since the mid-1960s offshore. The existing projects combined with the proposed

project would have the potential to slightly exacerbate existing effects on land use. However within the context of regional conditions, the addition of proposed project facilities are not unusual and would only slightly add to the sum of incremental land use changes that have already occurred with oil and gas development in the upper Cook Inlet. Cumulative impacts on land and shoreline uses are deemed to be minor.

4.12.4 Mitigation Measures

To the extent possible, Forest Oil would control/restrict public access to, in, and through areas that it owns (such as in the Kustatan area) or in areas under their operational control.

The proposed project will be permitted, constructed, and operated consistent with local, state, and federal land use and management procedures, objectives, codes, and regulations. Specific permits and approvals that will be required are summarized in Section 8. As part of the permitting process, Forest Oil is planning to conduct a series of public meetings at various locations potentially impacted by the project (NCG 2001). Meetings would tentatively be held in the Kenai/Soldotna area, Homer, and in Anchorage.

4.13 TRANSPORTATION SYSTEM IMPACTS

4.13.1 Impacts of the Proposed Project

Potential impacts to transportation systems are associated with possible conflicts with existing vessel movements in the central inlet, primarily to and from the Port of Anchorage. Currently there are about 400 to 500 vessels that travel through the area each year on their way to the Port of Anchorage (see Section 3.12). The usable channel width for navigation in the area is about 7 to 9 miles, and the presence of the Osprey Platform should present no unusual or hazardous conditions for marine traffic through the area.

Construction impacts are expected to be minor; the pipelines are close to shore (1.8 miles) and located in relatively shallow water. The platform has also been placed in relatively shallow water, immediately west of the deeper main channel passing between the Forelands. Collisions with the platform are unlikely; it is located outside the main shipping lanes, therefore large vessels should not be in close proximity to the Osprey Platform. For both large and small vessels, the presence of the platform may actually serve as a navigation aid. Appropriate U.S. Coast Guard navigation aids have been installed to ensure that the operation is visible to passing vessels.

Overall, the impacts to existing transportation systems are expected to be negligible to minor for the proposed project.

4.13.2 Impacts of Alternatives

Impacts of Alternatives 2 (offshore pipeline to Kustatan) and 3 (offshore pipeline to Trading Bay) would be the same as for the proposed project. Alternative 4 (no action) would involve no construction or production operations and therefore would have no impact on transportation systems.

4.13.3 Cumulative Impacts

The Osprey Platform is already in place; conversion to production operations will not contribute significantly to cumulative impacts on transportation systems in Cook Inlet.

4.13.4 Mitigation Measures

No mitigation measures are necessary as no project impacts on transportation systems have been identified.

4.14 IMPACTS ON VISUAL ENVIRONMENT/AESTHETICS

4.14.1 Impacts of the Proposed Project

The Osprey Platform will be visible over a wide area of central and upper Cook Inlet, both during the day and at night. Particularly sensitive viewing populations include: visitors to the Captain Cook State Recreation Area; and villagers from Tyonek. However, given the presence of 15 other platforms in the area, its presence would not significantly impact the existing visual environment.

Other potential impacts to the visual environment include impacts from a major oil spill. Major impacts could result locally from a large oil spill in the upper inlet. These impacts would be short-term and probably restricted to highly oiled beaches. Overall, the potential impacts on the visual environment are expected to be minor to moderate for the proposed project.

4.14.2 Impact of Alternatives

Impacts on the visual environment of Alternative 2 (offshore pipeline to Kustatan) and 3 (offshore pipeline to Trading Bay) would be comparable to the proposed project. The alternatives include longer underwater pipelines and therefore would have a slightly higher probability of an oil spill. Under alternative 4 (no action), the Osprey Platform would be floated off-location, resulting in minor positive impacts on the visual environment.

4.14.3 Cumulative Impacts

Given the oil and gas industry development that has occurred in this area over the years, and the fact that the Osprey Platform is currently in place, conversion to production operations is not expected to contribute significantly to cumulative impacts on the visual environment.

4.14.4 Mitigation Measures

No specific mitigation measures have been identified for visual impacts. Mitigation measures presented previously to minimize the probability and consequences of a major oil spill would also be applicable to mitigate visual impacts.

4.15 RECREATION IMPACTS

4.15.1 Impacts of the Proposed Project

Recreational impacts may occur due to oil spills, increased population and industrial employment growth, and changes in the aesthetic characteristics of the landscape. The most severe impacts to recreation would be primarily associated with a major oil spill. The east side of Cook Inlet and offshore areas, particularly in the lower inlet, are heavily used by local and regional residents and non-resident tourists for recreational purposes. The west side receives less use, and this primarily occurs from local residents for subsistence activities. A major oil spill in the upper inlet potentially could result in a variety of impacts including:

- Locally heavy oiling of beaches used for clamming, beachcombing, and fishing.
- Real or perceived tainting of recreational fishing and waterfowl hunting areas and stocks.
- Restricted use of offshore recreational and tourist-related vessels due to the presence of oil on the water surface.

Loss of recreational values for coastal and offshore areas are expected to generally be short-term. On heavily impacted beaches, visible oiling may be present for one year, or longer in more sheltered areas. Even the perception of oiling could deter the use of beaches for several years after a major spill event. While locally these effects might be significant from a major spill, they would generally be short-term. In the absence of a spill, impacts are considered to be negligible. A major oil spill is not expected to occur during the life of the project (see Section 4.1.4).

4.15.2 Impacts of Alternatives

Impacts on recreation of Alternative 2 (offshore pipeline to Kustatan) and 3 (offshore pipeline to Trading Bay) would be comparable to the proposed project. The alternatives include longer underwater pipelines and therefore would have a slightly higher probability of an oil spill. Alternative 4 (no action) would have no impacts on recreation.

4.15.3 Cumulative Impacts

Oil and gas industry development that has occurred in this area over the years, has not affected recreation use and opportunities to date. The proposed project is not expected to contribute significantly to adverse impacts on recreation.

4.15.4 Mitigation Measures

Applicable mitigation measures include those presented previously to minimize the probability and consequences of a major oil spill.

4.16 CULTURAL, HISTORICAL, AND ARCHAEOLOGICAL IMPACTS

4.16.1 Impacts of the Proposed Project

Potential impacts on archaeological and cultural resources may occur from onshore activities associated with construction of the onshore pipeline/access road and the Kustatan Production Facility.

Lands adjacent to the proposed Kustatan Production Facility location are known to contain significant archaeological resources that will require protection. Forest Oil is working with the EPA and the SHPO to ensure that the State and Federal objectives with regards to these resources are met. This effort includes development of a Programatic Agreement which is provided in Appendix E.

In general, all known significant archaeological/cultural resource artifacts will be managed through consultion with the SHPO and EPA. Potential impacts could result from the inadvertent destruction of additional artifacts, which have not previously been identified and removed. Should additional artifacts be uncovered during the construction phase, appropriate actions would be determined through consultation with EPA and the SHPO and implemented.

Access to the area containing significant artifacts will be increased by construction of an access road through a previously undisturbed area. Trespassers could potentially use the access road, which will not be secured, to conduct looting and other indiscriminate and damaging activities on known and unknown sites located on private land in the West Foreland area. However, the oil companies operating in the West Foreland area (Forest Oil and Unocal) control all access roads within the local road system; the roads are normally used only for oil industry operations. The potential for disturbance of archaeological resources by trespassers is considered to be minor but could result in permanent impacts.

4.16.2 Impact of Alternatives

Alternative 2 would have the same potential impacts on the cultural, historical, and archaeological resources as the proposed project. Alternative 3 would have negligible impacts as it does not include activities in the Kustatan area. Alternative 4 (no action) will not involve any construction activities and therefore would result in no impacts to cultural, historical, or archaeological resources.

4.16.3 Cumulative Impacts

Cumulative impacts of development could cause adverse impacts to the rich cultural and archaeological resources in the West Foreland area. However, no other development is planned for this area (NCG 2001) and except for the pipeline/access road and the Kustatan Production Facility, it will likely remain mostly undisturbed. Therefore, cumulative impacts from the proposed project on cultural, historical, and archaeological resources are expected to be minor.

4.16.4 Mitigation Measures

The proposed project has been configured to avoid locations of archaeological resources. Forest Oil is working with EPA and the SHPO to ensure that the State and Federal objectives with regards to these resources are met. This effort includes development of a Programmatic Agreement; this agreement is provided in Appendix E.

The Programmatic Agreement specifies procedures for mitigating potential impacts on cultural resources associated with construction of structures, roads, pipelines, drill pads, material sources, or other activities that significantly disturb the ground surface or have other effect on historic properties. Major provisions of the draft Programmatic Agreement include:

- A meeting between EPA, SHPO, Forest Oil and other interested parties will be held in Anchorage each year to discuss the previous year's activities and activities scheduled for the upcoming year.
- Annual staff training of project managers will be conducted on the procedures regarding the identification of historic properties and cultural resources, including identification, discovery, and notification procedures when archaeological materials, human remains, or historic buildings or structures are encountered. Training will be conducted by Forest Oil's project archaeoogist.
- A cultural resource briefing will be conducted for all field staff by the project archaeologist or trained field supervisors, with recurrent training when working in areas that may be culturally sensitive.
- All archaeological and historical work will be conducted by an archaeologist, historian, architectural historian, and/or historical architect, meeting the appropriate qualifications as specified in Appendix E.

- Forest Oil must consult with EPA and SHPO in any area where activities are to take place and have not been previously examined, or where EPA and SHPO have determined the need for more extensive examination. Activities include but are not limited to construction of structures, roads, pipelines, drill pads, material sources, or other ground-disturbing activities.
- Efforts must be made by Forest Oil to identify historic properties in those areas where activities could affect historic properties, including background research, consultation, oral history interviews, and appropriate field investigations (under the supervision of the project archaeologist).
- All discoveries of archaeological or historical materials or properties will be documented by Forest Oil, and submitted to EPA and SHPO for review and consultation within three working days of discovery.
- Archaeological monitoring (under supervision of the project archaeologist) will be conducted during ground-disturbing activities; monitoring results will be submitted to EPA and SHPO.
- Archaeological and historical sites will be avoided to the extent possible. If disturbance is unavoidable, Forest Oil's project archaeologist will consult with EPA, SHPO, and other signatories of the PA as applicable within three working days of the discovery to identify actions necessary to make a Determination of Eligibility to the National Register of Historic Places and then carry out the actions.
- If a possible historic building, structure, or parts thereof are discovered in the area of potential effect, EPA and SHPO will be consulted; if EPA finds that the building or structure is eligible for inclusion on the National Register of Historic Places, EPA will make an assessment of adverse effect. If necessary, EPA will direct Forest Oil to develop a plan to lessen the adverse impact. Forest Oil will e required to obtain written authorization from EPA to continue work in the area of the structure.
- Forest Oil will ensure that no activity will knowingly disturb human burials or human remains, including fragmentary or isolated human remains. If human remains are inadvertently discovered during the course of activities, all activities will cease until the project archaeologist, in consultation with EPA, SHPO, and the Alaska State Medical Examiner, can investigate. The SHPO will be notified immediately. Treatment of Native-American remains is detailed in Appendix E.

Forest Oil also has policies in place that provide for strong disciplinary actions against disturbances to or removal of cultural resources (NCG 2001).

Through avoidance of these resources and proper mitigation, as detailed in the Programmatic Agreement, potential adverse impacts on cultural, historical, and archaeological resources are expected to be minor to moderate for the proposed project.

4.17 UNAVOIDABLE ADVERSE IMPACTS

This section describes unavoidable adverse impacts that are likely to be caused by the proposed project.

4.17.1 Soil/Sediment

Construction of the offshore and nearshore pipelines will result in unavoidable adverse impacts to soils/sediment due to disturbance of the seafloor during pipelaying operations, particularly if the pipe lay barge methods is used for the underwater portion of the pipeline. Seafloor disturbance of 12 to 480 acres

will occur, depending on the pipelaying method used. Trenching through the shallow intertidal/subtidal area will also result in sediment disturbance, although the total area or volume disturbed is not known. Construction impacts are expected to be very short-term.

Onshore terrain disturbances will result from construction of the access road and pipeline through 1.8 miles of undisturbed area from the West Foreland to the location of the Kustatan Production Facility, and will adversely impact wetlands and terrestrial habitat in the area. Some terrain disturbance will also result from construction of the Kustatan Production Facility. Because construction of the proposed project affects only a small portion of undisturbed terrain, adverse impacts are expected to be minor.

4.17.2 Air Quality

Increased air emissions will result from construction and normal operations of the proposed project. However, emissions are not predicted to exceed 250 tons per year and therefore are not likely to result in significant adverse impacts.

4.17.3 Marine Water Quality

Unavoidable adverse impacts on water quality will occur as a result of construction activities (e.g., pipeline placement), primarily in the form of increased suspended sediment concentrations. Calculations indicate that suspended sediment concentrations at a downcurrent distance of 1,000 feet will be less than 50 mg/L; near the Forelands, suspended sediment concentrations of 100 to 200 mg/L are common. Construction impacts on water quality are considered short-term and very localized.

Permitted discharges from the Osprey Platform will meet all applicable water quality standards and are not expected to result in unavoidable adverse effects on marine water quality.

Oil spills during the life of the proposed project are likely to have adverse effects on marine water quality. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely. Based on average industry oil spill rates, 6 to 12 spills less than 50 barrels in size (with an average spill size of 5 barrels) would be expected to occur over an assumed 30-year project life. Moderately large spills (50 to 1,000 barrels) have a relatively high probability of occurrence. These oil spills could have significant effects on water quality; effects are expected to be short-term, however (e.g., less than 3 years).

4.17.4 Freshwater Resources

Unavoidable impacts on freshwater resources are related to the potential for an onshore oil spill from the the production facility or onshore pipelines. Private freshwater use of shallow groundwater may occur in the area, probably on a seasonal basis. Oil spills could adversely impact these resources. In addition, oil spills would adversely impact wetlands and wetland habitat.

4.17.5 Marine Biological Resources

Unavoidable adverse impacts on marine biological resources will occur as a result of disturbance and noise during construction, and oil spills. Construction will result in seafloor disturbance and thereby adversely impact benthic communities. Because benthic communities are fairly sparse in the project area (due to the highly energetic nature of the seafloor sediments), adverse impacts are expected to be short-term and minor. Noise and increased air traffic during construction will adversely impact local bird

populations, however these impacts are avoidable if appropriate mitigation measures are in place. Porpoises, killer whales, and seals may exhibit temporary behavioral reactions to construction activities.

Oil spills during the life of the proposed project are likely to have adverse effects on marine biological resources. The magnitude of these effects depends on the size, location, timing, and behavior of a spill. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely. Adverse impacts to benthic organisms, fish, marine birds, and mammals from an oil spill could be minor to significant, with potentially long-term consequences. Of particular concern are potential adverse effects on migrating birds.

4.17.6 Threatened and Endangered Species

Unavoidable adverse impacts to threatened, endangered, and depleted species are likely to occur from noise and general disturbance associated with construction activities, and oil spills. Construction activities could increase stress on the declining population of beluga whales in Cook Inlet, further reducing fitness and survivorship. These impacts are likely to be short-term and localized, however.

Oil spills during the life of the proposed project are likely to have adverse effects on threatened, endangered, and depleted species. The magnitude of these effects depends on the size, location, timing, and behavior of a spill. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely. Adverse impacts to individual Steller sea lions may occur, but the proposed project is not likely to adversely affect Steller sea lion populations or critical habitat. The beluga whale lives in Cook Inlet year-round, and may be particularly sensitive to environmental stress due to the low level and declining state of the population. Potential adverse impacts to belugas include death due to ingestion of spilled oil or oil-contaminated prey, inhalation of hydrocarbon vapors, skin and/or sensory organ damage, and reduced prey availability. In addition, displacement of belugas due to an oil spill could prevent access to important habitat areas where they feed. Any reduction in survivorship could be detrimental to the population.

4.17.7 Terrestrial Biological Resources

Unavoidable impacts on wetlands would occur as a result of construction of the onshore pipeline/access road in the West Foreland area. Approximately 772 lineal feet of wetland will be crossed by the proposed access road; about 360 feet of wetlands crossing can be avoided by rerouting the access road slightly to the north. Noise and general disturbance associated with onshore clearing and construction will impact terrestrial birds unless activities are conducted outside nesting periods. Minor and short-term construction impacts to terrestrial mammals will also likely occur, as well as displacement of a small number of animals due to habitat alteration associated with construction of the onshore production facility.

Onshore oil spills would adversely impact terrestrial biota. The magnitude of these effects depends on the size, location, timing, and behavior of a spill. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely. Impacts of a major oil spill on bears, river otters, and other mammals include increased mortality and habitat loss/contamination, but effects would be short-term and would be unlikely to affect regional populations. Birds could take up to three generations to recover from a major oil spill; oil spill impacts would be most severe during the summer when waterfowl are abundant in the area.

4.17.8 Socioeconomic Impacts

Unavoidable socioeconomic impacts would occur as a result of a major oil spill from the proposed project. In particular, potential economic losses to the commercial fishing industry due to fishing closure, real and perceived fish tainting, and oiling of gear could be significant. Impacts would likely be short-term. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely, and would have negligible to minor adverse socioeconomic impacts.

4.17.9 Subsistence Harvesting

Unavoidable impacts on subsistence harvesting would occur as a result of a major oil spill from the proposed project. In particular, subsistence harvesters in the community of Tyonek would be most likely to be impacted due to the potential loss of access to key subsistence food items and subsistence habitats including fish, clams, beluga whales, and ducks and geese. Impacts would likely be short-term. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely, and would have negligible to minor adverse socioeconomic impacts.

4.17.10 Visual Environment/Aesthetics

The Osprey Platform will be visible over a wide area of central and upper Cook Inlet, and therefore will result in minor and long-term adverse impacts to the visual environment. In the event of a major oil spill, adverse visual environment impacts to highly-oiled beaches would occur. This impact would be short-term.

4.17.11 Recreation

Unavoidable impacts to recreational resources would occur as a result of a major oil spill from the proposed project. Adverse impacts include: locally heavy oiling of beaches used for clamming, beachcombing, and fishing; real or perceived tainting of recreational fishing and hunting areas and stocks; and restricted use of offshore recreational and tourist-related vessels due to the presence of oil on the water surface. Recreational impacts are expected to be short-term and localized. Although a major spill is not expected to occur during the life of the project, smaller spills are considered likely, and would result in minor adverse impacts.

4.17.12 Cultural, Historical, and Archaeological Resources

Unavoidable impacts on archaeological and cultural resources are not expected to occur as a result of the proposed project because a Programmatic Agreement has been developed in coordination with the State Historic Preservation Officer (SHPO) and EPA to ensure that State and Federal objectives with regard to these resources are met. A Programmatic Agreement is attached to this EA as Appendix E.

4.18 SHORT-TERM USE VS. LONG-TERM PRODUCTIVITY

NEPA regulations (Section 1502.16) call for a comparison between the short-term effects from the uses of man's environment to long-term effects including the maintenance and enhancement of long-term productivity.

The proposed project as described in Section 2.2 involves the drilling and operation of wells for production of oil, natural gas and natural gas liquids; installation and operation of oil and natural gas processing equipment on-board the Osprey Platform; construction and operation of an onshore production

facility; and construction and operation of underwater and onshore pipelines to transport oil and natural gas from the platform to the production facility. The estimated project life is 20 to 30 years.

Economic, political, and social benefits would accrue from the availability of oil, helping to decrease the nation's dependence on oil imports. There would be direct and indirect benefits to local employment and local and state government tax and royalty revenues during the production phase. See Section 4.10.2 for a detailed discussion of tax revenue and employment benefits.

Many of the effects discussed in Section 4 are considered to be short-term (e.g., during construction and early operation phases), and can be reduced by the use of mitigating measures. Potential long-term impacts on productivity (e.g., impacts that will continue after the project is complete) are summarized below.

Destruction of Wetlands. The construction of onshore pipelines would result in impacts to approximately 26 acres of undisturbed area for construction of the access road and 3 acres of land for construction of the access ramp through the bluff. Although these impacts are permanent, they represent less than 0.2 percent of the West Foreland area. Four wetland areas totaling approximately 772 lineal feet of wetland crossings would be impacted by construction (or about 2.2 acres of wetlands). This is a permanent loss, however it is a relatively small area of the wetlands. Wetland mitigation and restoration activities would be specified and implemented under a Corps of Engineers 404 permit.

Damage to Artifacts. Archaeological and historic finds discovered during project construction would enhance long-term knowledge; any destruction of artifacts, however, would represent long-term losses.

Impacts on Biological Productivity from Oil Spills. The operation of the project could present long-term risks through the exposure of offshore and onshore environments to oil spills and/or pipeline related accidents and spills. The degree to which these risks could impact and affect various resources and the health, population levels and potentially the viability of certain species is discussed below. An estimated 25,000 barrels per day of oil and produced water will be transported via pipeline from the platform to the shore. Leak detection and SCADA systems and regular maintenance and inspection as well as spill prevention and contingency plans reviewed and approved by ADEC, U.S. Coast Guard and MMS should reduce the risks associated with a spill or pipeline leak or rupture.

An oil well blowout or pipeline rupture from the Osprey Platform or onshore pipeline rupture could result in long-term impacts on productivity and population viability to the following biological resources:

- Benthic communities could be impacted long-term in areas where oil is retained in sediment and persists for years. Also, the negative impacts of oil contamination on benthic invertebrates could indirectly impact higher trophic level species such as fish and birds, especially shorebirds that feed on benthic invertebrates.
- Sublethal effects to anadromous fish populations such as salmon would be long-term as petroleum hydrocarbons can reduce the homing ability of salmon (Babcock 1985).
- Oil spills are likely to negatively impact marine bird species. A large spill in an area of high bird concentrations could affect thousands of birds, causing high mortality, with full recovery taking up to three generations. The effects of contamination of prey organisms or other food sources can be long-term and result in reduction of reproductive capabilities of predator species (Patten 1993). Recovery for predator species can be lengthy and last for a number of years.
- Non-endangered baleen whales could be negatively affected for some time from an oil spill depending on the time of year, duration and quantity of spill. Movement of oil into lower Cook

Inlet or Shelikof Strait could affect a large number of individuals, including impacts on feeding during migration.

- Although not normally present in the project area, Stellar sea lions inhabit some areas in the Lower Cook Inlet and some can occur in the upper inlet. If a rookery was contaminated with oil, the current rate of population decline could accelerate significantly (Calkins et al. 1994).
- The beluga whale is the only year-round resident marine mammal in the upper Cook Inlet. Oil spills could be fatal to individuals through direct contact or reduction in prey. Displacement caused by oil spills and clean-ups could prevent access to important habitat areas where they feed. Any reduction in survivorship could be detrimental to the population.

4.19 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Regulations (Section 1502.16(f)) require identification of natural or depletable resource requirements and conservation potential. Oil resources in the Redoubt Shoal Unit would be irretrievably consumed under the proposed project.

4.19.1 Irretrievable Commitment of Resources

The Osprey Platform is a movable drilling platform that is already in place to support exploration drilling operations. The platform would be used to support offshore production operations. Conversion of the platform will require a limited amount of production equipment. No new construction would be associated with the platform. Because the platform is moveable and reusable there is no associated irreversible or irretrievable commitment of resources.

Onshore production facility and pipeline construction would require an irretrievable commitment of natural resources from direct consumption of fossil fuels, construction materials, the manufacture of new equipment that largely cannot be recycled at the end of the project's useful life, and energy for the production of materials. Furthermore, construction and clearing of the pipeline right-of-way and site of the production facility would necessitate vegetation and habitat removal, which could affect wildlife species in the region to a minor extent . Proper restoration and revegetation of the pipeline corridor would reduce long-term impacts.

Use of large volumes of groundwater (up to 800,000 gallons per day initially) from depths of 12,000 feet results in a long-term (and essentially irretrievable) commitment of water resources. While recharge of deep groundwater may eventually occur, it will likely take many years for the aquifer to fully recharge.

During the operational phase of the pipeline and production facility, the project would allow for the transport of additional nonrenewable resources, i.e. oil and gas, although the project itself would not utilize significant amounts of nonrenewable natural resources. The production facility and pipeline do not commit future use of petroleum products, instead they facilitate the movement and processing of the resource.

4.19.2 Irreversible Damage

With regard to irreversible damage, the potential exists for an accident associated with an oil spill or rupture of the pipelines. A spill or accidental pipeline rupture could result in adverse impacts on various environmental resources. Resource impacts could include loss or damage to sensitive marine and terrestrial biological resources and contamination of Cook Inlet and onshore surface waters and wetlands, with the potential to damage cultural resources. The potential risk and consequences of an oil spill or

pipeline accident are mitigable to some degree with the implementation of mitigation and safety measures, equipment, and emergency response plans outlined in this EA. The risk cannot be completely eliminated, thus the potential for irreversible damage remains.

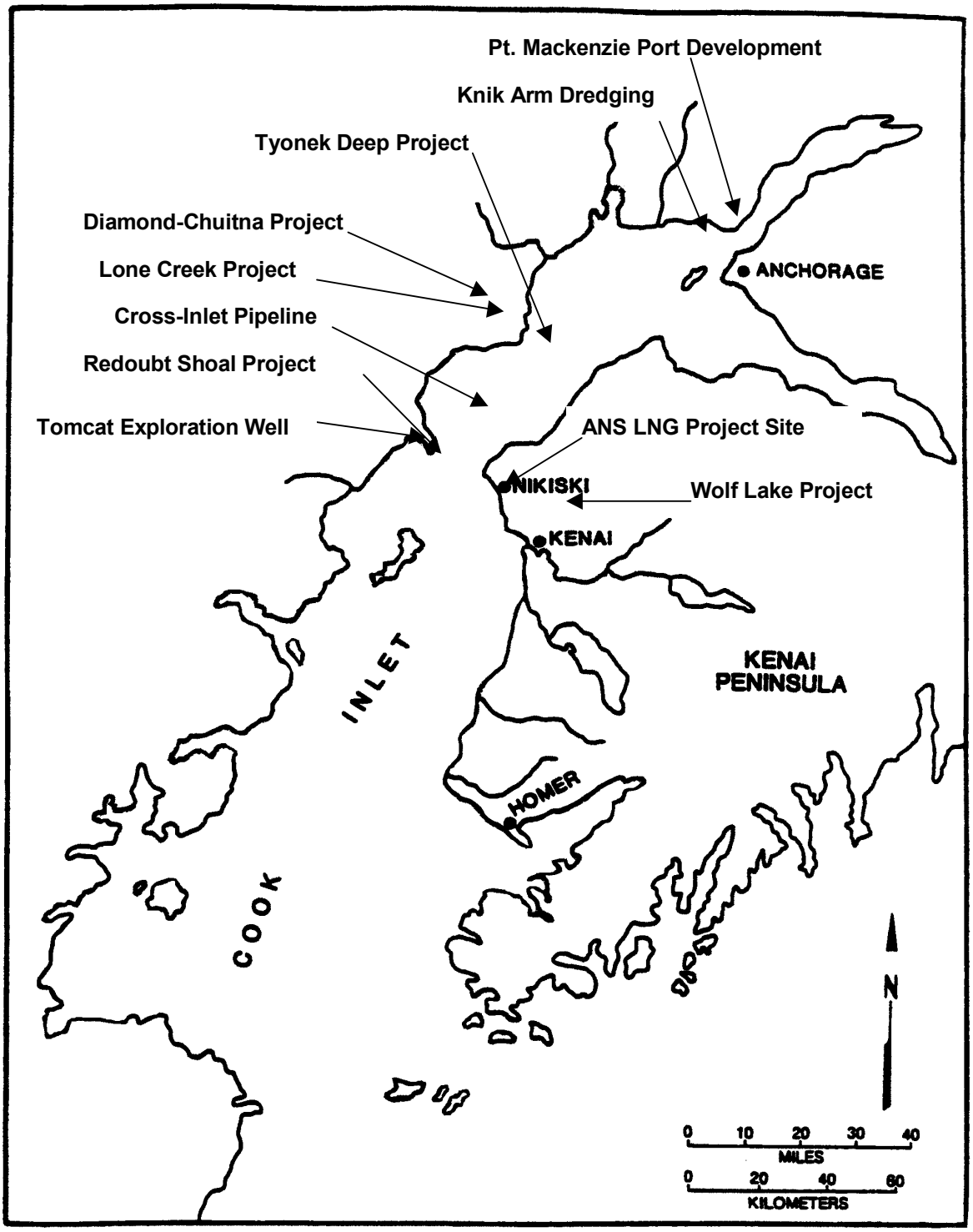

Figure 4-1. Locations of Planned and Potential Projects in Cook Inlet

Table 4-1
Summary of Potential Major Spill Sources and Proposed Mitigation Measures

Spill Source	Volume and Product	Major Mitigation Measures
Osprey Platform		
Diesel Tank Rupture	20,000 gallons diesel fuel	overfill protection; secondary containment
Well Blowout	5,500 barrels/day crude oil (1)	drilling mud weight; blowout preventers
Kustatan Production Facility		
Oil Tank Rupture	25,000 barrels crude oil	SCADA monitoring/control system; overfill protection; secondary containment
Produced Water Tank Rupture	5,000 barrels produced water	SCADA monitoring/control system; overfill protection; secondary containment
Pipelines		
Underwater Pipeline	1,633 barrels crude oil (2)	SCADA monitoring/control system; internal/external monitoring
Onshore Pipeline	1,633 barrels crude oil (2)	SCADA monitoring/control system; internal/external monitoring

(1) Regulatory/response planning standard set by ADEC

(2) Equal to line volume plus one hour of flow and ignoring topographic limitations/trapping (i.e., worst case)

Source: NCG 2001

Table 4-2
Oil Spill Potential for the Redoubt Shoal Unit

Spill Size (barrels)	Spill Rate (spills/Bbbl)	Average Spill Size (Barrels)	Predicted Number of Spills During Project Life	
			Total Production 25 Million Barrels	Total Production 50 Million Barrels
1 to <50	234	5	5.9	11.7
50 to <1,000	9.8	160	0.25	0.49
>1,000 (Platform)	0.6	50,000	0.015	0.03
>1,000 (Pipeline)	0.67	10,500	0.017	0.034

Bbbl = billion barrels
Sources: NCG 2001, MMS 1995

Table 4-3
Summary of Other Potential Projects In Cook Inlet

Project Name/Location	Description/Project Components
Forest Oil Tomcat Exploration Well West Cook Inlet	The project included exploration drilling in the Kustatan area. An access road from the West Forelands #1 site to Kustatan was constructed and the well drilled in the fall of 2000. Commercial quantities of hydrocarbons were not found, and this project will not proceed as a production project.
UNOCAL, et al. Cross-Inlet Oil Pipeline Upper Cook Inlet	The project would include construction of an oil pipeline from the Granite Point area on the west side of the inlet to the Nikishka Bay area on the east side of the inlet. The primary objective of the pipeline would be to transfer existing oil production from the Drift River Terminal (which would be then put in "warm" shutdown) directly to the Nikiski area. The project is currently in conceptual phase and permitting could be initiated if it is determined to be economically viable. Currently the project is believed to have a low probability of proceeding.
ARCO Alaska, Inc. et al. Alaska North Slope LNG Project Southcentral Alaska	The project includes a 28 to 30-inch natural gas pipeline from the Alaska North Slope with gas liquefaction facility at tidewater and associated marine transportation. Project is in the planning stage with potential marine sites at Nikiski in the Cook Inlet area and at Anderson Bay in the Prince William Sound area. The project is still in the preliminary evaluation stages and would likely not be constructed until 2007 or later.
Marathon Oil Company Wolf Lake Project Kenai Peninsula	The project is an onshore gas production operation northeast of Kenai on the east side of Cook Inlet. Project is currently in the permitting stage and is planned to come in operation in 2000/2001 timeframe.
Phillips Petroleum Co. Tyonek Deep Project Upper Cook Inlet	The project would include addition of oil production equipment to an existing gas platform in the inlet and construction of about 17 miles of onshore/underwater pipelines to transport crude oil and natural gas to the Granite Point area. Permitting was initiated in 1998 but was recently suspended due to project economics.
Anadarko and Phillips Lone Creek Project West Cook Inlet	The project would include development of an onshore gas prospect in the general Chuitna River area on the west side of the inlet. The project would require a gas pipeline possibly to the Granite Point area. The resource was identified in 1998 and could be developed by Phillips Petroleum Company possibly as early as 2003 if determined to be economic.

Table 4-3 (Continued)
Summary of Other Potential Projects In Cook Inlet

Project Name/Location	Description/Project Components
DRven Corporation Diamond Chuitna Coal Project West Cook Inlet	The project would include development of an onshore open pit coal mine, transportation systems to tidewater and a marine port site in the general Tyonek area. The project was permitted in the 1980s. The project is still active but currently on hold pending a market for the coal. It is not believed that the project will proceed in the immediate future.
Tyonek Native Corporation Tyonek Industrial Park West Cook Inlet	The Tyonek Native Corporation has been actively promoting developing and industrial park on the west side of the inlet near Tyonek. Various potential industrial operations have been pursued including an iron reduction plant, but specific commitments have not been developed.
Corps of Engineers Knik Arm Dredging Project Upper Cook Inlet	The multi-year project includes deepening of a vessel navigation channel into the Port of Anchorage. Dredging operations are currently underway and should continue through the summer of 2000.
Matanuska Susitna Borough Point Mackenzie Port Upper Cook Inlet	The project includes construction of a small vessel dock in the Point Mackenzie area of upper Cook Inlet. The project has been constructed, but there has been no major associated developments or operations identified to date.

Source: NCG 2001

Table 4-4
Preliminary Emissions Inventory for the Redoubt Shoal Unit

Equipment	NO_x (tpy)	CO (tpy)	PM_{10} (tpy)	VOC (tpy)	SO_2 (tpy)
Onshore Production Facility[1]					
Turbine Generators	135.0	97.2	5.4	38.7	1.5
Crude Heaters	27.2	23.2	2.4	1.6	0.0
Fire Water Pump	0.6	0.1	0.0	0.1	0.0
Process Flare	0.2	1.3	0.1	0.7	0.0
Glycol Reboiler	0.3	0.2	0.0	0.0	0.0
Glycol Still Vent	0.0	0.0	0.0	36.1	0.0
Process Fugitives	0.0	0.0	0.0	30.9	0.0
Crude Tanks	0.0	0.0	0.0	61.5	0.0
Slop Oil Tank	0.0	0.0	0.0	3.7	0.0
Small Space Heaters	1.6	1.4	0.1	0.1	0.0
Total	165.0	123.1	7.7	173.2	1.7
Offshore Platform--Drilling Equipment[2]					
Clayton ROG-100 Boiler No. 1	2.9	0.7	0.3	0.04	5.0
Clayton ROG-100 Boiler No. 2	2.9	0.7	0.3	0.04	5.0
Parker GO 4032 No. 1	2.1	0.5	0.2	0.03	3.6
Parker GO 4032 No. 2	2.1	0.5	0.2	0.03	3.6
Caterpillar D399 Engine Nos. 1 thru 5 and D379 Engine	1.2	0.2	0.1	0.1	0.1
Caterpillar 3412 Engine Nos. 1, 2	2.7	2.3	0.4	0.2	0.4
Waukeska F-1197DSU Engine	0.2	0.03	0.01	0.01	0.01
Caterpillar 3406 Engine Nos. 1, 2	9.6	6.1	1.1	0.7	1.2
Test Flare	9.3	50.5	3.6	8.6	0.5
Total	33.0	61.5	6.2	9.8	19.4

Sources:
1 HCG 2001a
2 HCG 2001b

Table 4-5
Increased Suspended Sediment Concentrations During Pipelaying Operations

Downcurrent Distance (feet)	Plume Area (sq. ft.)	Suspended Sediment Concentration (mg/L)			
		1-knot current	2-knot current	3-knot current	4-knot current
100	1,010	135	67	45	34
500	2,050	66	33	22	17
1,000	3,330	41	20	14	10
5,000	13,700	10	5	3	2

Source: NCG 2001

Table 4-6
Summary of Proposed Discharges from the Osprey Platform

Effluent	Volume of Discharge	Frequency of Discharge	Parameter	Maximum Daily Level	Average Daily Level
Deck Drainage	108,000 gallons/day	daily	Temperature	<70ºF	<60ºF
Domestic Wastes	4,000 gallons/day	daily	Oil & Grease	No Sheen	No Sheen
Boiler Blowdown	100 gallons/event	weekly			
Fire Control Test Water	22,500 gallons/event	monthly			
Non-Contact Cooling Water	300,000 gpd	daily			
Sanitary Wastes	2,020 gpd	daily	BOD	60 mg/L	<60 mg/L
			TSS	60 mg/L	<60 mg/L
			Temperature	<70ºF	<60ºF
			Oil & Grease	No Sheen	No Sheen
			Total Chlorine	>1 ppm	>1 ppm
Excess Cement Slurry	4,200 gallons/event	30 events/year	TSS	<200,000 mg/L	<100,000 mg/L
			Temperature	<80ºF	<60ºF
			pH	<12	<9
			Oil & Grease	No Sheen	No Sheen

Source: NPDES Permit Application, submitted to EPA on 2/29/2000 (Appendix A)